MUNICIPAL ENGINEERING

VOLUME XLII NUMBER FOUR

APRIL, NINETEEN HUNDRED TWELVE

Practical Road Building.*

By John N. Edy, C. E., Highway Engineer, Billings, Mont.

SAND-CLAY ROADS.

IN THIS and the following chapters we will be concerned chiefly with the construction of the several kinds of wearing surfaces, assuming that the drainage and foundation features have been cared for.

All road users are familiar with the effects of different climatic conditions upon roads of sand and of clay. While the former are at their best when wet and become practically impassable during the hot, dry months, the clay road is in best condition in the summer and is least serviceable in winter. For this reason an effort has been made to so combine these two materials that the resulting surface will give better service than when either is used alone. It has been found that if the intense hardness of the sand grains be used for wearing purposes and the stickiness of the clay be utilized for binding these sand grains together, the road thus formed is hard, smooth and resilient, and very inexpensive. The sand-clay road, then, is a combination of sand and clay in such proportions that every grain of sand is in contact with its neighbor, with the air spaces or voids in the sand just filled with a binder of clay. In order that these conditions may be fulfilled—

1. The sand must be clean and sharp and preferably coarse.
2. The clay must be free from sand and must possess the quality of binding.

It may be further noted that such a surface may be built under either of two conditions, namely:

1. On a sand foundation.
2. On a clay foundation.

Before explaining the different methods of construction it might be well to emphasize the following points: The sole object in building a sand-clay surface is to improve the condition of the road, causing it to more nearly serve the requirements of the traffic. It is therefore to the advantage of the community that the road be improved to the highest state of perfection possible with the materials at hand. And so far as a combination of sand and clay is concerned the whole success of the improvement depends upon the thorough mixing and compacting of the materials in the proper proportions. For this reason such methods will be outlined that will, with the exercise of some judgment, insure the best immediate results.

Sand-Clay on Sand.—under this head we may discuss two conditions: Construction on deep sand and on shallow sand. In the first case it is usually desirable to cover the deep sand with a layer of, say, 10 inches of clay, and then place a sand-clay surface on this in the same manner as on a clay foundation, using a thinner surface coat. A very satisfactory method to use on a shallow sand foundation is as follows:

Determine the width to be improved, say 15 feet. The road is then crowned slightly with a road machine, and shoulders are thrown up at the sides to confine the clay. The clay is hauled and spread carefully over the surface, 6 to 8 inches deep at the center and 3 to 4 inches deep at the sides. This binder is covered with a thin layer of sand. The whole mass is then thoroughly pulverized and mixed by plowing and harrowing. Note that in this case the amount of clay used (an average depth of 4 to 6 inches of loose material) should produce

*Copyright by John N. Edy.

a total thickness of 8 to 10 inches. The materials having been mixed dry, they should be wet by sprinkling and again harrowed. If it is not possible to sprinkle the road, the puddling may wait until after a rain, when it should be carefully done. After this wet mixing the surface is shaped with a grader and thoroughly rolled. As has been noted, the value of the improvement depends upon the intimate mixing, puddling and compacting of the sand and clay.

Sand-Clay on Clay.—Under this condition, after the shoulders are formed as above, the clay is loosened to a depth of, say, 4 inches, and all clods and lumps broken with the harrow. Coarse, sharp sand is then spread to an average depth of 8 inches, spreading somewhat deeper in the center than at the sides. This mass is then mixed by plowing and harrowing, puddled, shaped and rolled.

Another method is to haul the sand when the weather is good, distributing it along the road and applying after a rain, but before the road is cut into ruts. In this manner some labor is saved, but it is questionable if the final results are as desirable, because of the non-uniformity of the mixture. The sand might be dumped upon deep mud and do no harm, but this operation is more costly.

It is to be remembered that the depth and width of improvement depends upon the volume of traffic to be cared for. Furthermore it will be found that the proportions selected are not absolutely correct, and that sand or clay must be added along the roadway to make the mixture uniform. In fact, the construction of a sand-clay road is rather a matter of experiment and development until the two ingredients have been supplied in just the proper proportions; then the construction ceases and the maintenance begins.

For estimating purposes it is customary to test the sand for voids in the following manner: Take two glasses or other measure of equal volume. Fill one with water and the other with the sand to be used. Pour water from the glass into the sand, stirring constantly, until the water is just flush with the top of the sand glass. By observing the water that remains we may estimate the quantity that has been removed, which is the measure of the voids in the sand. The percentage of voids varies with the sand and the moisture it contains.

Any excess of clay over that required to fill the voids in the sand is undesirable, and will mean the application of more sand. On this account and because it is difficult to measure these voids accurately and then thoroughly mix the materials, it is desirable that piles of suitable sand or clay be kept along the road for use when necessary.

The maintenance of a sand-clay road is conducted principally with the road drag, together with the addition of such material as may be required to keep the surface in a uniformly good condition.

Before selecting the clay to be used a careful investigation of all the available pits should be made, and that clay chosen which packs readily, and pulverizes slowly when dry, or softens slowly when wet. A few simple tests will suggest themselves for this determination. A ball of clay may be placed in a glass of water, and its behavior noted. The longer it holds its shape the better suited it is for the purpose. Immediate slaking may indicate the presence of sand, which is undesirable. Another ball of clay placed on a glass should not crumble readily when dry; and when mixed with the sand in the assumed proportions, should show few, if any, cracks.

It might be well to state here that when a sand-clay road shows cracks, these cracks must be immediately filled with sand. This may usually be done by using the drag. The supervisor must understand that in this, as well as in other highway improvement, the value of the result depends largely upon the exercise of judgment in adapting the method to the conditions and upon his patience, care and perseverance.

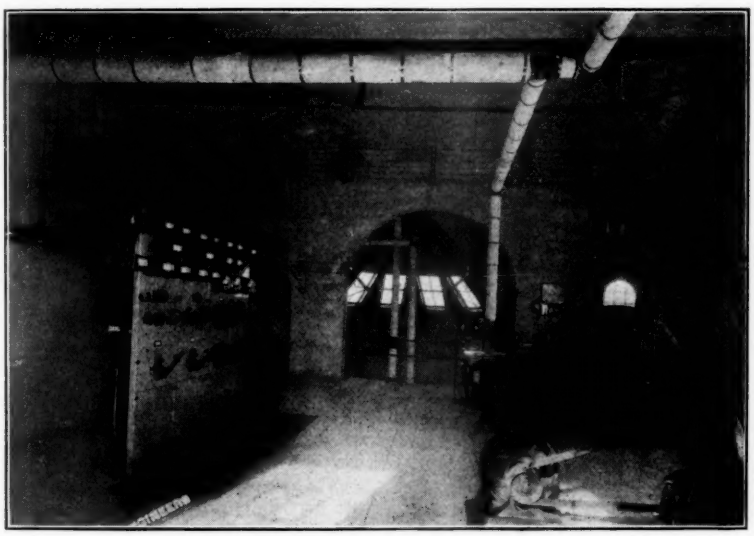
The crown of a sand-clay road should be approximately the same as for earth roads, ¾ or 1 inch per foot. The bottom of the side ditch must be at least 20 inches below the center of the roadway.

The cost of this construction varies with the local conditions. These roads have been built for 10 cents to 17 cents per square yard. It is probable that an eight-inch, fifteen-foot surface, constructed as outlined above, may be built under average conditions for one thousand dollars ($1,000) per mile. These roads are always cheaper than macadam, and, except on a clay base where gravel may be had easily, are cheaper than gravel. In fact, many of the so-called cheap gravel roads are in reality expensive sand-clay roads, the gravel taking the place of the sand.

Combined Electric Light and Water Works Plant at St. Marys, Kansas.

By Frank C. Perkins, Buffalo, N. Y.

DURING the past year nearly forty municipal electric lighting plants have been installed in the state of Kansas, where a state law has been passed allowing the state school fund to purchase the municipal bonds required for the construction of these water works and electric light stations. In the state of Oklahoma an even greater number of municipal electric light plants and water works have been erected during 1909. The accompanying illustration shows the electrical end of a typical installation of this type at St. Marys, Kansas, using fuel oil in the boilers for generating the steam and doing away entirely with the inconvenience and expense of handling the coal. The electric plant consists of two direct connected high-speed engine generator sets with exciters belted to pulleys on the extended shafts of the alternators outside of the main bearings. The electric installation is in duplicate, the switchboard and electric generator set being mounted in a separate room from the pumping plant.



ELECTRIC LIGHT AND WATER PLANT, ST. MARYS, KANSAS.
Electric Generators and Switchboard.

The street lighting of the town of St. Marys is equipped with series tungsten lamps which give a pure white light, instead of the yellow rays of the ordinary carbon filament lamp, and at one-third the operating cost of the latter.

The boilers are operated with great economy in labor on account of the use of fuel oil, which is supplied in carload lots at 1⅞ cents per gallon, delivered into the city's storage tank at the station, which has a capacity of two carloads of oil.

The pumping plant consists of two horizontal compound duplex pumps, located in a brick pump pit and connected with the main suction pipe, which is installed in a brick tunnel connecting the three wells, which are about 40 feet deep. The water supply is taken from these wells, which are away from the drainage of the city, west of St. Marys. Cast iron mains are used throughout the city for distribution, domestic and fire pressure being secured from an elevated storage tank or from direct pressure. This station is operated most economically, giving both electric lighting service and water service at minimum cost, on account of the combining of the service to the greatest advantage in low first cost of plant, and therefore reduced fixed charges, as well as low maintenance cost and operating expense, the same labor being utilized for attending the lighting and pumping installation.

Proportioning Gravel Concrete.*

By Clifford Older, Springfield, Ill.

THE bridge work of the Illinois Highway Commission involves the use of concrete under the greatest variety of conditions imaginable. The quality of concrete required varies from that necessary in massive plain concrete abutments and retaining walls to that required for light, thin reinforced floors for steel bridges.

The conditions under which concrete is built vary throughout all seasons of the year, and the location of the work may be in a city with ample transportation facilities, or it may be 20 miles from a railroad with dirt roads and 10 per cent. grades intervening.

The quality of available aggregates may be the best of crushed limestone and coarse river sand, or it may be gravel of infinitely varied character. The quantity needed for the work may also be anything from a few cubic yards to several hundred or even thousand cubic yards.

Handling the construction of a large number of concrete structures under greatly varying conditions made it necessary to devise a set of specifications for concrete work which would provide for concrete of satisfactory quality under all conditions and yet be elastic enough to permit the use of a considerable variety of aggregate.

When the bridge is located comparatively near a railroad station, it is frequently possible to secure broken stone and sand at a reasonable cost. Many county highway bridges, however, are located perhaps 5, 10 or 15 miles from a railroad, in which case, if broken stone and sand were required, the cost of concrete structures would be beyond the reach of many communities.

Gravel.—The admission of gravel for aggregate permits the economical use of concrete in practically all Illinois townships, however remote from stone supply. Gravel as nature provides it has, however, an infinitely varied mixture of sand, pebbles and stone. Gravel as known to local highway officials and to most contractors may, in some cases, contain stone from 3 inches in diameter down, and in others it may be a material all of which will pass through a ⅜-inch or even a ¼-inch screen. It is all popularly known as gravel, and the standard mixture is 1 part of cement to 6 or 7 parts of gravel.

The abuse of gravel concrete in small country highway work is astonishing. One local contractor, who was building a small bridge, insisted that a proportion of one of cement to six of gravel meant one sack of cement to six wheelbarrows of gravel.

The specification adopted provides for the use of broken stone and sand when available by stating the number of parts by volume of each ingredient. Screened gravel is treated in the same way. Unscreened gravel is also permitted under certain conditions.

The clay or loam content is limited by the specifications to 2 per cent. of the sand. But few natural gravels will satisfy this requirement. Larger percentages are frequently allowed if the gravel is otherwise of good quality.

To secure the necessary strength, the cement is proportioned according to the amount of sand contained in the gravel, sand being defined as that part of the gravel which will pass through a ¼-inch screen. The only requirement as to the relative proportions of sand and stone in the gravel is that the volume of sand must not fall below six-tenths of the volume of stone. Any gravel, therefore, having a sand-to-stone ratio greater than 0.6 may be used without modification, but for gravel so used the cement-to-sand ratio must be constant for a given class of concrete.

This provision permits the use of practically all gravels composed of satisfactory material. The resulting proportions stated in the usual form may vary, for a certain class of concrete, from 1 part cement to 2¼ parts sand and 4 parts of stone to a mortar mixture of 1 part of cement to 2½ parts sand.

This method of proportioning is based on the assumption that if the sand and the stone are of satisfactory quality, and the ratio of sand to stone is equal to, or greater than 0.60, the strength of the concrete will be satisfactory, providing the ratio of cement to sand, or, in other words, the mortar is always maintained constant for a given class of concrete.

Specifications for broken stone and gravel concrete require for class X concrete 1 part cement, 2 parts sand and 3½ parts rock broken to pieces which will be retained on a ⅜-inch screen and which will pass a 1-inch ring; for class A concrete 1 part cement, 2½ parts sand and 4 parts rock broken to pieces which will be retained on a ⅜-inch screen and which will pass a 1-inch ring, and for class B concrete 1 part cement, 3 parts

*From a paper before the Illinois Society of Engineers and Surveyors.

sand and 5 parts rock broken to pieces which will be retained on a ¾-inch screen and which will pass a 2½-inch ring.

Gravel may be used in the place of broken stone and sand for concrete if it consists of clean, hard and sound stones, pebbles and sand, having a reasonably uniform gradation from the coarsest material allowable for the work specified to fine sand.

In proportioning gravel concrete, frequent tests are made to determine the proportion of sand to stone. For class X and class A gravel concrete all material which passes a ¼-inch screen and passes a 1-inch screen is considered stone. For class B gravel concrete all material which passed a ¼-inch screen is considered sand and all material which is retained on a ¼-inch screen and passes a 2½-inch screen is considered stone. For any of the classes of concrete, should the volume of sand so found be less than 60 per cent. of the volume of stone, sufficient sand must be added to bring up the proportion. Should the volume of sand be more than 60 per cent. of the volume of stone, stone must be added or sufficient cement so that the volume of cement to sand shall be for class X concrete as 1 to 2; for class A concrete as 1 to 2½; and for class B concrete as 1 to 3.

Pit-run gravel is defined as a mixture of sand and stone.

Sand is that part of pit-run gravel which will pass through a ¼-inch screen.

Stone is that part of pit-run gravel which will be retained on a ¼-inch screen and which will pass through a screen of the size indicated for the given class of concrete.

Sometimes it is convenient to proportion gravel concrete by relative volumes of cement and total aggregate. To determine this relation, first compute the number of sacks of cement per cubic yard of the aggregate as it is to be used in the mixture; then the volume in cubic feet of cement per cubic yard of aggregate equals 0.95 of the number of sacks and the proportion of cement to aggregate equals 27 divided by this quantity.

It is often cheaper to resort to screening in order to obtain the stone necessary to modify the gravel to the 0.60 ratio than it is to add cement or purchase broken stone.

With cement at $1 per barrel on the ground and 30 cents as the cost of screening 1 yard of gravel, assuming that the gravel is free at the pit or that it is necessary to purchase only the amount of gravel hauled away, it will be seen that screening is cheaper than adding cement up to where proportion of same is 0.90. With the cement on the ground at $1.50 per barrel and screening at 30 cents per yard; gravel being free at the pit or the material hauled away only being paid for, there is a very marked saving in cost by screening up to a proportion of sand of 0.93 over the method of adding cement.

With cement at $1.50 per barrel, screening at 30 cents and gravel at 40 cents, all gravel screened as well as that hauled being paid for at this rate, it is still cheaper to screen the gravel in order to find stone to add than it is to add cement up to values of sand ratio of 0.85.

With cement at $1.50 and broken stone at $2 per yard delivered at the bridge site, the adding of broken stone is cheaper than adding cement, cheaper than screening if all gravel handled must be paid for at the rate of 40 cents per cubic yard, and is cheaper than screenings alone for values of sand ratio larger than 0.8.

A Typical Example.—An example of a case where the method of adding cement proved the cheapest for proportioning follows:

A bridge located about nine miles from the nearest railroad station required about 350 cubic yards of class A concrete. Cement was delivered at the bridge site at cost of $1.35 per barrel. At the site of the bridge occurred a deposit of gravel containing but a small amount of stone, the sand, however, being of excellent quality. The gravel was had at the cost of shoveling it into wheelbarrows. Broken stone at the nearest railroad station would have cost $1.75 per cubic yard, and the haul on account of the grades would have cost $4 per cubic yard, making the cost of broken stone at the bridge site $5.75 per cubic yard. The gravel in the creek bed tested 0.93 sand and 0.12 stone.

Using the gravel as it occurred in the creek bed required the use of 2.60 barrels of cement per cubic yard of concrete, the cost at $1.35 per barrel being $3.51 per cubic yard. Had broken stone been added, it would have been necessary to purchase about 0.7 cubic yard per cubic yard of concrete. This would have cost at the bridge site $4.02. The cement necessary would have been reduced to 1.2 barrels and would have cost $1.62 per cubic yard of concrete. The cost of cement and stone per cubic yard of concrete would have been about $5.64. The saving per cubic yard of concrete effected by adding cement at the rate of 1 of cement to 2½ of the contained sand amounted to $2.13. As there were 350 cubic yards used, the total saving amounted in this case to $745. The resulting concrete appears to be excellent.

Screening was out of the question, as to obtain the stone required would have necessitated screening nearly 1,800 cubic yards of gravel, and the visible supply was much less than this.

In general the specification for gravel concrete herein described, which has been in use by the Illinois Highway Commission for several years, has resulted in satisfactory concrete, and made concrete structures available in many places where the cost would have been prohibitive had a fixed ratio of sand to stone been required in all cases.

Electric Wire Conduits at Westfield, Mass.

By Henry D. Jackson, C. E., Boston, Mass.

ON the 4th day of May, 1910, the town of Westfield, Mass., at a regular town meeting, elected a committee of nine men to serve as a committee on the repaving of Elm street and Park Square in the town of Westfield, Mass. This committee was also authorized to investigate, and if deemed advisable, install an underground system by means of which the wires of the municipal plant would be put under ground. Also to install an entire new lighting system for the district to be repaved. This district composed the main street of Westfield from the river to and including the streets around the park in and about the centre of the town. This required the placing underground of three arc circuits, two lighting circuits, and one power circuit, or the removal of at least 16 high tension wires from the main streets, as well as the secondaries and the transformers.

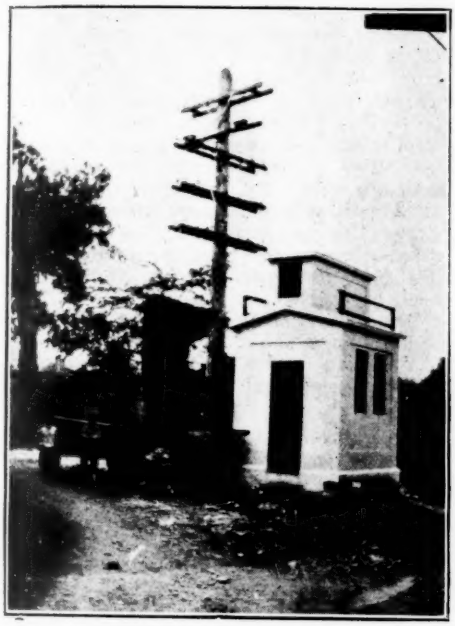
A careful investigation of the situation showed that the best method was the installation of a wire house or terminal house on the dyke at the southerly end of the bridge across the Westfield river, fairly close to the power station. From this terminal house a 12-duct conduit was carried in a southerly direction through Elm street to the junction of Main street. At this point it changed from 12-duct to 8-duct up Elm street to Court. The section down Main street was 12-ducts and Broad street was 8-ducts. At each street crossing, a manhole was located, with a section of conduit running down each street to a sufficient distance to keep the general neat appearance of the main street unobstructed. At various other locations distributing boxes and conduits were located in order to distribute the current from the main ducts to buildings, or alleyways which could not be dignified by the name of streets. At the end of each distributing duct a junction box was located, to enable the wires to be drawn from the ducts to the pole conduit.

The main line of conduit has entrance only at the manholes and terminal house. The distributing boxes are located with reference to the top four ducts, and have physical contact only with these ducts. The entire main conduit, and general line of distributing conduit, was made of standard section Camp tile, either 2, 4 or 6-duct, laid in concrete, and thoroughly protected in a 3-inch wall of concrete on either side, as well as on the top and bottom. The ducts for the arc light poles are of section round tile pipe 4 inches in diameter, as are also the ducts in the terminal boxes to the pole conduit.

The manholes are all standard dimensions, 5 x 5 square. All manholes, where feasible, are drained to the sewer. The distributing boxes are 30 inches square, and of varying depths, depending upon the number of ducts entering, the standard width being 4-ducts. The terminal boxes, where necessary, are round, 22 inches in diameter at the bottom and 26 inches in diameter at the top, being 12 inches deep inside. Both service boxes and manholes are provided with solid cast-iron covers.

The specifications covering this work were made as complete as possible in every detail, covering all precautionary sections usually covered in municipal work for the protection of the town, also for the protection of both contractor's employes and the townspeople. The specifications were carefully divided into sections of various characters of work done, each section being completely covered in its entirety with reference to the material used and the method of using it. The prices were obtained for each individual item, also as regards the total estimate of work to be done and unit prices per foot of duct, per terminal box or per manhole.

The contract for the installation was let to the Safety Insulated Wire and Cable Co., of New York, and was satis-



CONDUIT WORK IN WESTFIELD, MASS.
Terminal House with Pole for Distributing Lines.

factorily accomplished. The terminal house was not included in first contract.

During the time conduit was being installed, the committee investigated the different types and methods of street lighting at present in use; and finally decided to use the luminous arc or magnetite arc for the Main street, with a few series incandescent on the same circuit, current for these being supplied from tub transformer and mercury arc rectifier.

With the idea that it was good business to make the entire system as neat and attractive as possible, considerable attention was paid to the type of poles, and final decision was for the iron ornamental pole shown in the accompanying photograph of Elm street after removal of wires. These poles are set in concrete at frequent intervals along the main street, park, etc. The lamps are carried at approximately 25 feet above the street, and with the number of lamps installed, Westfield should have a main street as well lighted as any city or town in the country.

The cable installation was under a second contract and specifications, and was also secured by the Safety Insulated Wire and Cable Co. This contract also included the installation of the pole ducts, and the setting and wiring of the arc light poles. The specifications drawn up for this work called for either varnished cambric or varnished paper insulation, alternative bids being requested. After a careful deliberation of the prices submitted, it was decided that the paper cable was for the price most satisfactory, and paper insulation was selected. The specifications were carefully divided into a large number of sections, in order to get accurate figures on not only the cost of the various materials, but the labor involved in its installation. In all there were some 26 items, including furnishing the different characters of cable, for installing the same, for making taps, all joints being included in the installing of the cable, for furnishing cutouts, for furnishing and installing castings for connecting the conduit to the arc light poles, for installing the various characters of service outlets, for furnishing and installing the pole terminal fittings, such as V V fittings and potheads, for furnishing and installing hangers in the manholes, for furnishing and installing the protecting listing on wire in manholes, terminal boxes and distributing boxes, and for furnishing the necessary transformers and instruments and making the test. These various items were carefully covered in the specifications, both as regards the quality of the material supplied, work done, and method of using material. Also all necessary clauses for protecting the town and contractor were

CONDUIT WORK IN WESTFIELD, MASS.
Installation of Wires to Street Lamp. Transition from Lead Cable to Rubber Covered Wire. End Bells will be Filled with Paraffine.

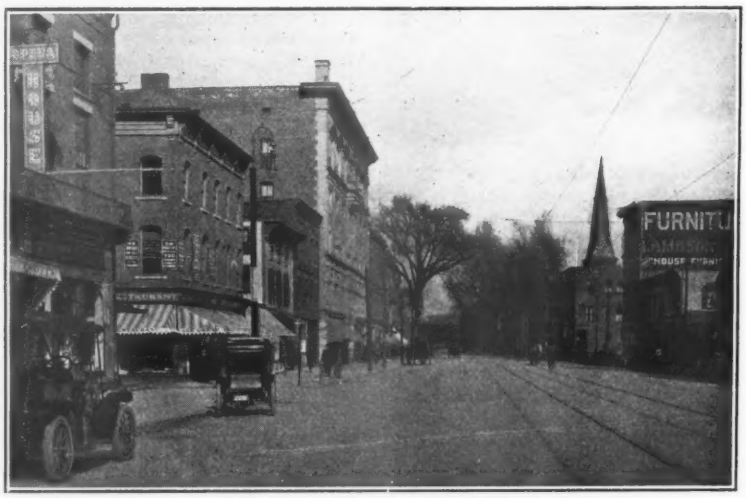
carefully inserted in accordance with the standard form of contract used by the town of Westfield.

The drawings in connection with these specifications were made as complete as possible, the location of each wire or cable being carefully indicated in each duct, also where the joints were to be made, and how the cables were to be drawn from the main line duct through to the distributing ducts to and up the poles. The power and light cables in the main section through Elm street to Main street are No. 0 wire. The laterals are No. 4 and No. 6. The circuit from Main to Court street is No. 4, down Main St. No. 2, and down Broad street No. 4. All of this cable is standard 3,000-volt paper insulated cable, with standard thickness lead sheath, and was tested for 4,800 volts for thirty minutes. All cable is of stranded wire and single conductor.

The arc light cable is No. 6, solid, 8,000-volt, standard cable, and was tested for 12,800 volts for thirty minutes.

The two cables composing one side of the two-phase circuit are pulled into the same duct, and the two wires composing an arc circuit are pulled in the same duct wherever feasible. The wires when leaving the terminal boxes for poles, are carried through fibre or iron bends, depending upon whether there is more than one wire in the conduit or not. Where more than one wire is used, iron pipe is installed. Where single wire is run, a fibre pipe is used. The iron pipes are carried from the terminal boxes up the poles to a height of at least 10 feet above the ground. From this point to just below the lower arm, the conduit is composed of Orangeburg fibre. At the top of all of these ducts is placed a V V fitting, from which the wire is carried by a smooth curve to a Davis pothead, which is fastened to the lower arm, the junction to the different circuits being made at this pothead. This construction makes a very neat and attractive appearance, and is thoroughly effective as regards the protection of the cable, besides allowing the ready removing of the line from the cable by taking off the pothead cap at any time.

The arc cables are carried from the conduit to a short circuit switch in the base of the pole, at which point cable sheath is grounded to the pole. The wiring in the pole itself is composed of a twin conductor solid No. 8 rubber-insulated wire, which is carried from the cutout switch to the cutout suspended with the lamp.



ELM STREET, WESTFIELD, MASS.
View After Installation of Conduit and Lamps and Removal of Overhead Wires.

In order to bring the wires from the power station to the cable, a terminal house was installed on the dyke near the Westfield river. In this terminal house are located the choke coils for protecting the cable, also fuses and switches, which will enable the cable to be cut out at any time without affecting the rest of the circuits. The illustrations show with more or less distinctness the construction of the cable house and its appearance after completion, with the terminal pole from which the wires run to the house. They also show the junction of the lead cable to the rubber-covered cable at the base of the arc light pole, as well as the appearance of the streets

after the installation of underground service.

The entire layout of this work—both constructions, including plans, specifications and form of contract—was drawn up by Messrs. Sprague, Keyes and Jackson, engineers, 88 Broad street, Boston, who also supervised and inspected the work at frequent intervals. The general construction work was supervised by the town engineer, Mr. Oren E. Parks, and his assistants.

The Meadow Boulevard to Atlantic City, N. J.

Editorial Correspondence.

NEW JERSEY has a hard surface road which has been built upon a foundation as treacherous and unstable as the material known as "quicksand." This road, the "Meadow Boulevard," connects the sand-bar island, upon which Atlantic City is built, with the main land; taking a course across the salt marsh flats, where previous to that time there had been a toll road in service only under favorable conditions of wind and tide

The first railroad to Atlantic City, the Camden and Absecon, had a terminus at the edge of the meadows, or marshes. This was afterward extended over the more solid portions of the flats to the island. The railroad ties were laid without ballast upon stiff sod which floated on the mud beneath. Train schedules were uncertain as storm tides frequently interrupted travel for days. The increase in weight of locomotives and the uncertainty of operation finally caused the railroad to build a more permanent road bed, bringing sand from some distance to obtain a fill which would displace the soft mud until sufficient bearing surface was obtained to give the desired results.

A wagon toll road of the corduroy type had been constructed between Pleasantville and Atlantic City. This structure in reality floated on the mud of the meadows and occasionally the sinking of the entire surface made necessary the expensive hauling and placing of gravel from the mainland. The construction of a state road from Camden brought a great deal of traffic to the toll road and it became a paying investment, as will be understood from the fact that though the distance was less than 4 miles a charge of sixty cents per team for each round trip was made. When it was proposed to construct a state road across the marshes a great deal of opposition was made by the toll road interests, but the purchase of the road for use as a right of way by a trolley line finally disposed of this opposition.

A survey was accordingly made and a right of way, one hundred feet in width, was obtained and the actual construction work was undertaken in 1903 under the direction of Robert A. Meeker, state supervisor of roads, with J. J. Anderson, county engineer of Atlantic county, in charge. The length of the roadway constructed was 3.58 miles.

Soundings taken along the right of way showed that the semi-liquid mud varied in depth from six feet to twenty-eight feet and the surface was covered in most places with a salt marsh grass sod varying in depth from two to four feet in thickness. Below this was found a layer of hard pan which in a few places was only about four feet thick. Below this was a seemingly bottomless stratum of soft mud. This was particularly true at the points where it was decided to construct bridges to allow for the thoroughfares and bays from the ocean.

Pile bents were constructed to support the approaches to these bridges. These piles were put down by water jet and hammer combined. They were driven to a depth of about thirty feet as at about thirty-five feet all resistance to the hammer ceased and the piles sank indefinitely.

After the road was definitely located, sod banks were constructed, five feet six inches high, twelve feet wide at the base, and two at the top and with the growing grass side out. The inside edges of these banks were sixty feet apart and formed the outer boundaries of the roadway. The sod was taken from between the walls as it was found that as the fill was placed between them, the weight displaced the mud to such an extent that in a number of places the crust without the walls was raised.

After the walls were finished a mixture of sand with about 90 per cent. of water was pumped by hydraulic dredges for a distance of about one-half mile or more, and discharged between the sod walls. The sand settled and the water ran back into the bay. As this settlement continued the mud was displaced until the

roadway rested upon the hardpan or until an equilibrium was established and the sand, spread to an umbrella-like cross section, formed a surface capable of supporting the fill and roadway. After the sand fill was completed to a height of about six feet above the level of the meadows, a coat of gravel was applied and the roadway was leveled and given the proper curvature. A substantial railing was erected at each side of the boulevard and the road was thrown open to traffic which has continued without interruption by the tide since 1903. The method of construction here used has since been adopted in a number of cases for shore road building.

The gravel which formed the top of the roadway was of excellent quality having sufficient clay to make a binder, causing it to form a closely knit surface which has required some maintenance each year, but which under the exceptionally heavy traffic has given very good service. The Meadow Boulevard forms the only roadway connecting the great seaside resort, Atlantic City, with the mainland. It is the last link in the great highway from Philadelphia to the sea; and by reason of the great numbers who come across the country to Atlantic City, it carries an automobile traffic alone of over a million and a half vehicles each year. In addition to this class of traffic there is a great market gardening business due to the number of hotels, and the market stuff is hauled in wagons which are horse drawn; so that the road has to withstand combined horse and automobile traffic of the most severe type.

By reason of the cost of maintenance due to the exceptionally heavy traffic, the county board of freeholders of Atlantic county decided to construct some more permanent surface for that portion of the boulevard adjacent to Atlantic City. Accordingly a contract was let for the resurfacing with Warrenite the portion near to Atlantic City, for a distance of 0.6 mile, and the roadway was constructed under the direction of E. D. Rightmire. Great care was taken in the construction, due to the width of the roadway, fifty-eight feet, and the small crown allowed. The accompanying photograph shows the excellent condition of the surface at the present time.

After the preparation of the subgrade a six-inch rolled layer of 2½-inch trap rock was spread and a binder course of stone screenings and gravel was added. Upon this foundation was placed a two-inch layer of Warrenite surface, which consists of graded stone mixed with Warrenite bituminous cement. This layer was thoroughly rolled and compacted and a flush coat was added. The addition of stone screenings and thorough rolling completed the roadway.

MEADOW BOULEVARD ROAD, ATLANTIC CITY, N. J.

The resulting road is as hard and smooth as a city asphalt street and thanks to the careful supervision and attention to detail there is excellent drainage and no pockets are afforded in the comparatively flat surface for the retention of water.

Water Meters, Mains and Service Pipes from the Financial Standpoint.*

By Willis J. Spaulding, Commissioner of Public Property, Springfield, Ill.

A YEAR ago next April our city passed an ordinance requiring all services to be metered within two years. On March 1st last we had about twenty-two hundred meters in use. March 1st, this year, we had about five thousand in use. Our daily pumpage has been steadily decreasing, and we have been able to supply the city from our wells regularly for the past six months. While we had to meet a good deal of prejudice in the start, I think it is safe to say that fully three-fourths of our consumers are satisfied, and more are being converted every day. I am told that in one large city the past season the supply to all residences was cut off at the curb key to save the water for fire protection. Later the installation of meters was begun. Had this city been on the meter system probably this drastic measure would not have been necessary.

It is only necessary to make the patrons understand that conservation means in the end lower rates and better service for them. The proposition is simple. For example, if ten million gallons are pumped through the mains, and only five millions devoted to legitimate use, the five millions of waste must be added into the bills of consumers the same as if they had used it. If those five millions which were wasted were sold, it is obvious that the rates could have been reduced fifty per cent. and the water department still have received the same gross income, less the cost of additional mains.

One matter that should not be overlooked with reference to the meter system is that a meter is a machine and will get out of order. A water system had better not be metered at all, at least from a revenue standpoint, if the meters are to be installed and then allowed to take care of themselves. I think it is a serious mistake for the consumer to own the meter. The water department should own, install, and take care of them, and so keep its records that it can know the history of every meter from the time it was installed down to date. Our experience is that meters seldom get fast, but continually become slow. In the past summer we started a test of all meters which had been in service more than two years. The test was made at the premises. These tests showed that about four meters out of five were from five per cent. to ninety per cent. slow. It should be explained, however, that these meters had been in for from two to twelve years. Most of them had been in service eight or ten years. To illustrate, we removed a meter which had been yielding seventy-five cents per month in revenue, and replaced it with an accurate one. The revenue at this place rose to thirteen dollars. Reference to the ledger showed the registration had been gradually falling off for several years. Of course, the consumer feel greatly aggrieved and assumed that he was being robbed, but was finally convinced that he was wasting a great deal of water and by a change of management cut his bill down to about four dollars per month, which in his case, might be considered normal. This is only one of many similar cases. I think it is safe to say that on all meters that had been in more than eight years we were losing forty per cent. in income on the average. Tests for accuracy should be made at regular intervals not more than two years apart. We expect to follow up the work of installing and complete it this summer.

In our city, as in many others, free water was given to various institutions from the beginning, and these were added to from time to time, until we had a great many such consumers. We have a park system which is provided for by State law. The revenue is provided for by a special tax levy. It is no more fair for the water department to furnish them water free than to pay for the park policemen. The water department is no more obliged to furnish the public schools free of charge than to pay their janitors. It is no more entitled to furnish the cemetery with water than to pay the grave digger. In our city we have put these and a number of other free consumers on the pay list. At one school building when the meter was first installed the consumption was at the rate of about seventy-five dollars per month. This, of course, was largely due to leakage.

In this matter of free water there is a question of equity which is often over-

*From a paper before the Illinois Sanitary and Water Supply Association.

looked in municipal management. It is assumed that a water plant should be self-sustaining, and on this point there is no argument. If the funds of the water department are diverted to other uses, it is obvious that in that case water consumers are being made an object of special taxation indirectly through the water rates. For instance, suppose that the water rates were placed high enough so that the revenue would not only support the water plant, but would pay the cost of maintaining the fire department also. Then a citizen would be taxed to support the fire department, not in proportion to the property owned, but in proportion to the water he used, and a substantial portion (say one-half of his water bill) would really be a charge for fire protection, and fire protection for the whole city would be paid for by water consumers, while nearly one-half the people enjoy the same protection and pay nothing. The furnishing of free water is only another method of diverting the funds of the water department away from their proper channel, and to that extent an unfair burden is being placed upon those who pay for water. On account of its importance from a sanitary standpoint, we can not fail to see the urgency for promoting the general use of a public water supply, and the most certain way to do this is by making it as cheap as possible. A city cannot be made beautiful or sanitary until every working man can enjoy the advantages of city water. In our city only a little more than half of the residents are water takers, and one of our problems is to increase the number.

The matter of water rates, however, is of no greater importance than the necessity of making the service easily available. That is to say, the distributing main must be accessible to the prospective consumer, and the installing of the service pipe should be made as easy and inexpensive as possible. Home builders can not take city water if there is no main within reach. At the same time any water department can easily bankrupt itself by draining its resources for water main extensions from which there is insufficient revenue. One of the problems now before our water department is the question of how best to provide revenue for extensions. In the past we have been meeting this expense from the revenues. In a prosperous and growing city the cost of water pipe extensions commonly amounts to about twenty-five per cent. of the gross income.

There are three ways in which this expense may be met: from water revenues, by bond issues, or by a special assessment against the frontage. In the first instance water consumers foot the bill directly; in the second it becomes a permanent interest bearing obligation against water patrons. By either of these two methods it must be provided for in the rates. By the third method it is paid once for all by the owners of the property benefited, and in that case the rates for water could be reduced approximately twenty-five per cent., and at the same time leave the department the same net income. In the past two years we have had some large additions laid out in the residence part of the city. These additions were not available as home sites without city water. Since there were no consumers immediately to be had the water department refused to make extensions. The owners of the additions concluded to lay the mains at their own expense, and the argument to justify the expenditure was as follows: Investment for water pipe in front of these lots would amount to about $14.00 for each forty-foot lot; for the expenditure of $14.00 on the lot its value was enhanced at least double that amount, so that as a matter of fact the investment in water pipe paid a profit of one hundred per cent. to the owner of the frontage. As the lots were sold the real estate dealer received the money he had invested in the pipe, together with one hundred per cent. profit on it, so that the water department surely could not be said to be in debt to him. Therefore, no refund was made. Now under the old method of paying for the water pipe from the water revenue the lot owners would have collected the value of the water pipe from the home builder just the same. The home builder who improved the lot by putting a house on it would probably proceed to pay for the water pipe in his water rates as soon as he had become a water consumer, notwithstanding that he had already paid for the pipe twice over when he bought his lot. This would seem to be a ridiculous inconsistency which penalizes the home builder in favor of the lot owner, and at least in the case of municipal ownership could just as well be avoided. The cost of sewers and of pavements is acknowledged as a legitimate charge against the frontage and is paid for accordingly. The value of a water main in front of a lot is much more certain and tangible than sewers or pavement, because there is scarcely any business or purpose for which the lot could be used that water would not be necessary or desirable. It is like bringing an ever-flowing spring, and flowing under pressure, within reach of the lot, and though a resident may use no water at all the fire protection means an annual saving in insurance. It is perfectly natural that a real estate

owner should capitalize the value of a water main and charge it to the home builder who buys the lot, just as he would charge for a sewer, a pavement, or a boulevard. Therefore, what is more logical or fair than to require him to pay for the main in the beginning, since he gets the money back with perhaps one hundred per cent profit?

Charging water pipe to the frontage is not new in this state, and is quite general in Minnesota, but there they have a method of spreading the cost over a period of ten years, collecting the amount with the regular tax assessment, which makes the annual charge so small that it is scarcely noticed and makes the collection in a very inexpensive way.

The advantages to a city of some such method are far reaching. Under such a plan water pipe would be extended in all directions as new additions were laid out, instead of being held back until such time as there are enough consumers to make the extension profitable, thus avoiding the unfortunate necessity of compelling many home builders to provide themselves a well and outhouse on their lot. Finally when the main is extended, often a large number of residents have become settled and satisfied, and will not put in the service. Many persons in planning a new house will put in city water but the same persons would not rearrange an old house. This method accomplishes three things of vital importance: first, it makes the water available to those who want to use it; second, it reduces the cost of water in two ways, namely, by relieving the water department of the cost of extensions, and by greatly increasing the number of patrons; third, and above all, it is the most equitable plan yet devised.

A weak feature commonly found in the administration of public water works is that the installing of service pipes is done by the plumbers. In our city it has cost from thirty-five to fifty dollars to install a service pipe. This is about double what it would be if the department did the work at actual cost. A water plant should expect to earn its revenues from the sale of water, and should therefore be interested in making it as easy as possible for citizens to obtain the service. With that idea in mind our city council introduced an ordinance providing that all services shall be installed by the water department at cost, and by this means we are enabled to make a uniform charge which applies to both the long and short services alike so that the resident who happens to be on the long side of the street will have to pay no more than if he were on the short side.

Sewage Sludge Disposal.

By I. Batley, Late Superintendent of Sewage Works, Bradford, England.

THE disposal of sewage sludge in England is a problem which is now having serious attention by city engineers and others in charge of municipal sanitary arrangements. The writer's intention in this article is to give an outline of the methods adopted at various works in experiments made to dispose of sewage sludge economically. At the works at Frizinghall, which treat the sewage of the city of Bradford, the raw sewage is of a very complex nature, owing to the large quantity of waste water which comes from the various industries, comprising wool combing, dyeing, brewing and a host of other trades.

The dry weather flow is about 15,000,000 gallons daily. This passes over a series of tanks which collect all the heavy matter, and then through revolving screens, which collect all the waste paper, water closet refuse, etc. Sulphuric acid is then added in just sufficient quantity to "crack" the water, which passes over a series of fifteen precipitation tanks. The sludge with the grease in combination falls to the bottom and when the tank is full the water course is turned.

The resultant sludge, containing about 80 per cent. water, is then run by gravity into a large ram, where it is then pumped up into the presses, the grease and water running away all the time.

The cake, when it leaves the presses, contains about 30 per cent. moisture, and 15 per cent. grease left in. The calorific value compared with coal used on the works is about half. A number of experiments have been made to effectively deal with the quantity of cake made (about 40 tons per 24 hours), a few of which will be of interesting description. At one time the cake was crushed into small pieces and fed into a series of eight D-shaped retorts, heated underneath by a generating furnace. Superheated steam was blown through the cake as it was scraped slowly on by a chain belt with iron scrapers attached.

The fatty matter passed off at the top and was drawn through condensers and afterwards refined. The grease was of poor quality, owing to the quantity of tarry matters that also came over with it. The plant itself was not a success. Depreciation and repairs were expensive items, and eventually it was thrown on the junk heap.

Successfully to burn the cake, also to avoid using as much coal, with which it had to be mixed before burning, it was decided to gasify it in a twin gas producer and use the gas for firing a water tube boiler, with the ultimate idea of also recovering the nitrogen as ammonia.

Although the scheme had merits, the difficulties were numerous. Chief amongst these was the ash, which clung to the corners of the brickwork lining of the producer and gradually built up until it formed a solid mass in the chambers. The gas was of good value and was ignited under the boiler for generating steam. As the control over the gases was not effective, the pressure in the boiler was very erratic and could not be relied upon to supply the works with steam with regularity.

This plant was also passed as of no further use, but not before it was thoroughly demonstrated that it would not be of practical use.

The water tube boiler was then fitted with a chain-grate stoker. Sewage cake in proportion to coal was burnt here., three tons of cake to four tons of coal being used. This was fairly satisfactory, nevertheless the question of burning all pressed cake and no coal was never lost sight of, and to this end, with a view to removing the remaining moisture in the cake, a large rotary drying machine of American make was installed. This machine did its work well. The wet cake, partly crushed, was fed in at one end and left at the other in fine dry powder. A trial run in burning the powder on the chain-grate stoker which had been installed was sufficient to prove that there was no advantage in burning it, as the fine powder formed one solid mass of clinker, entirely preventing any air coming through the grate to oxidize the combustible products.

All this time a small quantity of the cake had been disposed of as a fertilizer base, about $1.50 per ton being obtained for it, when sent out in powder form. This demand grew to large proportions and the rotary drying machine, which turned out about 30 tons of dry product every 24 hours, was kept hard at work to keep up with the demand. The price of the dry powder was also gradually increased until $2.50 was obtained for it. The demand of course varies, but in the spring large quantities are sent away. The powder shows on analysis 2 to 2.5 per cent. ammonia.

At Leeds a small experimental plant has been erected for recovery of the ammonia from the pressed sewage cake. This plant was not at work when I saw it. Mr. Hart, the sewage engineer, spoke highly of it as far as his results had gone, and it certainly has merits. The previously dried sewage cake is fed into an iron retort at the top, which is built in a brick chamber leaving an annular space between the inner wall of furnace and outer shell of retort for heating purposes. Connected to this space is a small gas producer. The producer is started up and charged with ordinary coke and the gas ignited under the retort, which, when sufficiently heated drives off all combustible products from the sewage cake, leaving a fine ash at the bottom of retort. The gases are led from top of retort through a condenser, the ammoniacal liquors and a small portion of oil separates out, the combustible gas is led into the bottom of retort which serves in place of the gas producer, making the plant nearly self-supporting. The producer is used only when starting up the plant. No figures as to cost of production were yet available, but it appears to be an idea with vast possibilities.

At Tadcaster, a brewery town, in Yorkshire, of about 3,000 population, a rotary dryer is at present being installed of similar make to the one at Bradford. The sewage, which is chiefly composed of brewery waste, is treated with lime. About 300 tons of 90 per cent. sludge is made weekly. It is proposed to dry this by pumping it direct into a dehydrator, which will reduce it to 75 or 80 per cent. moisture, and then run directly into the dryer. The cost per ton for drying, including labor, fuel, capital outlay, etc., on plant, will be about $2.00 per ton of dry product, and as there is a good market for it at $5.00 per ton, sewage, instead of being drug, will prove of good value and a profitable industry as well.

At Huddersfield the sewage is pumped from the sedimentation tanks into some natural reservoir near, no efforts having yet been made to deal with it. Most towns press the sludge, the cake having 50 to 70 per cent. moisture left in. This is given away to farmers free for removing, sometimes 12 to 18 cents per ton also with it, depending on the location of the works and the manurial value of the sewage. Low lying land is also filled up, this being the method generally adopted.

Manchester, Salford, Glasgow, and other cities within easy reach of the coast take the sewage sludge out to sea in boats. This also applies to some portion of the sewage of Dublin, Ireland. Near to the Dublin works, Fertilizers, Ltd., a

company formed to work the patent of Mr. A. Dickson for treating sewage sludge, are operating. The process consists of adding a certain amount of waste brewery yeast to the sewage sludge, fermentation taking place, the organic matter rising to the top and the heavy matter falling to the bottom. The organic sewage is dried and sells readily at $12.00 per ton. When I was at the works in May last, orders for over 1,000 tons were already booked. The cost of production is about $3.00 per ton, therefore, if the process works satisfactorily, the stockholders in the company will be well rewarded. The analysis of the dried manure is as high as 3 per cent. nitrogen. It yet remains to be seen as to the merits of it as a fertilizer. One obstacle in the way of the process being generally adopted would be the difficulty of obtaining the spent yeast in sufficient quantities. Only a small percentage is used however, and it was later found out that by leaving a small portion of the fermented sludge in the bottom of tanks it would start the fresh sludge.

At Norwich a separate company is also being formed to take the sludge for treatment after leaving the precipitation tanks. This sewage is very rich in nitrogen, and also contains about 30 per cent. oil when in the dry state. It is proposed to recover this, and dispose of the residue for fertilizer. As this plant is more of an experimental scheme and has not yet been demonstrated no definite opinion can be given at this point.

At Warrington, Lanc., the town is more on the pail system. The contents are collected, which contain 90 per cent. water. This is evaporated down to 60 per cent. in vacuum pans and then run into steam jacketed dryers to dry into powder form. The output is about 20 tons weekly. It is bagged up, and sold as "poudrette," $20 a ton being obtained for it.

Oldham, Lancashire, is at present erecting a plant, value $50,000, for recovering the grease, and making a dry product at the same time which will be sold as a fertilizer. The grease is sold to distillers, olein, stearine, and pitch being obtained from it. Similar attempts with plants of this kind have been made. Needless to say they have not yet proved successful.

Great strides are now being made in regards to the question of sewage sludge disposal. No general method can be adopted in dealing with it, as each case varies according to the different industries carried on.

Residential Sewage Disposal Plants.*

By R. Winthrop Pratt, Chief Engineer of State Board of Health, Columbus, Ohio.

ALTHOUGH a privy vault or cesspool might be in general classed as a residence sewage disposal plant, yet the true definition of such a plant would include only a scientifically designed apparatus capable of purifying or disposing of the sewage in a definite, sanitary and controllable manner.

The two chief principles upon which depends the successful operation of a house sewage disposal plant are:

First. The clarification of the sewage by causing the solid matter to settle to the bottom of a tank and there become partially liquefied, and by causing the grease and light suspended matter to rise to the top in the form of scum; and,

Second. The disposal of the clarified liquid either (a) in a specially prepared filter; (b) over the surface of the ground; or (c) into the soil beneath the surface.

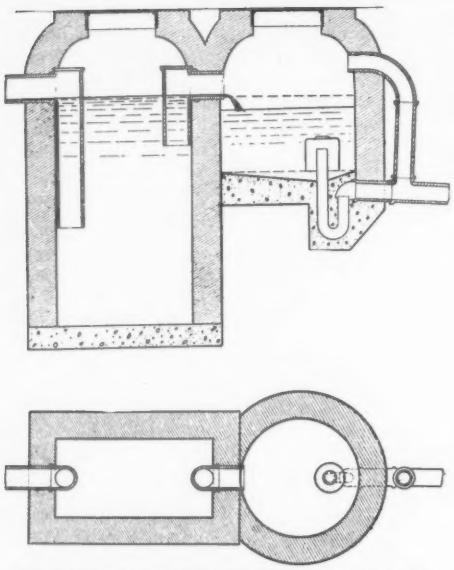
The process depends, aside from its mechanical workings, upon bacterial action; and without attempting to enter into a bacteriological discussion, it may be of interest to mention that the essential bacteria are of two general classes.

The first class of bacteria inhabit the tank and perform the function of partially changing the solid matter into liquids and gases. They are known as anaerobic (those working without oxygen) and facultative (those working either with or without oxygen). The bacteria are assisted in their work by worms and other animal organisms.

The second, or the aerobic, class of bacteria inhabit the filter or the ground used for the final purification of the clarified sewage. The function of this class is to transform the organic matter of the sewage into harmless and odorless mineral matter, thus causing or tending to cause the disappearance of the dangerous germs of the original sewage.

A plant designed according to the above mentioned principles may be described somewhat as follows: The outflowing sewage from the house is delivered into a settling basin of sufficient size and of suitable design to afford opportunity for the sedimentation of the solid matter and the rise of the grease.

*From a paper before a conference of boards of health.



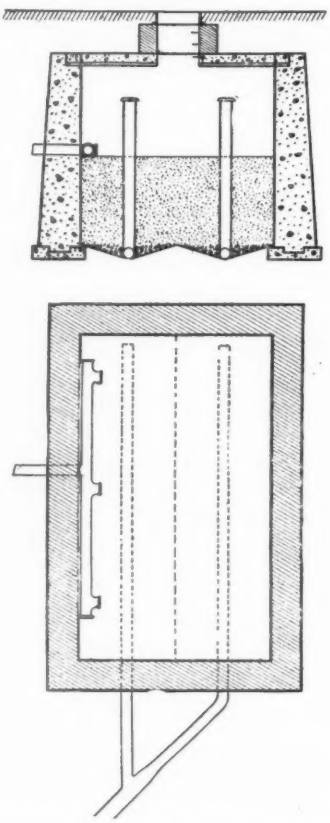
RESIDENTIAL SEWAGE DISPOSAL PLANT.
1. Vertical Section and Plan Showing Settling or Septic Tank and Dosing Chamber.

This basin or tank contains a constant volume which approximately should equal one or two days' flow of sewage. The inlets and outlets should be so arranged that neither the scum at the top nor the sludge at the bottom is disturbed as the sewage passes through it. The matter deposited in the bottom of the tank becomes partially reduced and passes away in the form of liquid or gas. There will be, however, a certain accumulation which must be cleaned out occasionally, probably not oftener than once a year. The tank should be ventilated through the main soil pipe of the house in the same way in which modern sanitary sewer systems are ventilated.

The clarified liquid overflowing from this tank passes into a second one adjacent thereto, called the dosing tank. Herein is placed an automatic siphon or other controlling device which holds back the flow until the sewage has reached a certain depth, at which time the entire contents of the dosing tank are discharged very rapidly. The discharge completed, the apparatus automatically prevents further outflow until the tank becomes again full. This tank serves to apply the sewage to the filter, sub-surface disposal system, or other means for final purification, to which the capacity or "dose" must bear a certain relation in order that the sewage be properly distributed.

Such distribution is essential for the reason that, if the sewage is allowed to pass on to the filter or into the "absorption system" in the same irregular way that it leaves the house, the filtering material will be constantly saturated in places and hence become clogged and foul. In other words, the filtering material must be kept clean by allowing the air to frequently penetrate it. (See Fig. 1.)

The disposal of the clarified sewage by open filters and by broad irrigation is identical in principle with the corresponding methods for city plants and need not be described here. Of course, these can be used only where ample land is available; and they are not suitable for built-up districts, but rather for isolated houses. In any case these methods involve exposing the unpurified sewage to the air and are, therefore, less desirable than a sub-surface system. If, however, one wishes to construct a filter bed in a concrete chamber beneath the ground, this can be satisfactorily done, though somewhat expensive, in close proximity to residences. (See Fig. 2.)



RESIDENTIAL SEWAGE DISPOSAL PLANT.
2. Vertical Section and Plan of Intermittent Sand Filter Underground.

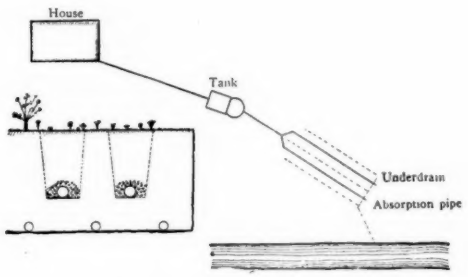
The sub-surface disposal system is composed of lines of three, four or six-inch agricultural drain tile or vitrified pipe with open joints, laid level or nearly so, within one or two feet of the surface of the ground. These are called absorption or distribution pipes. Their total length is determined primarily by the porosity of the soil in which they are placed and varies for a family of five or six, from 100 to 600 feet. In clayey soils it is necessary to thoroughly underdrain the land at a depth of three or four feet in order to render the soil dry enough to absorb the sewage, and in addition it is desirable to surround the tile with gravel, cinders or porous material. There should be, of course, no opportunity for sewage to pass directly from the absorption pipe into any of the underdrains. As mentioned above, the cubical contents of the absorption system should have a certain relation to the dosing tank in order that the sewage may be properly distributed. It is often convenient, furthermore, to divide the system into two or three portions in order that the flow may be changed from one to the other every few weeks.

There will doubtless be a certain accumulation of finely divided solid matter in the tile which may make necessary their relaying after a period of years. This, however, is a matter of small importance. The system can be placed at any convenient point and is often installed underneath the lawn or vegetable garden without in any way showing evidences of its existence, except by assisting in the growth of vegetation. (See Fig. 3.)

While the general principles of the design of municipal sewage purification plants apply also to residential plants, yet there are several practical differences which should be borne in mind.

In the first place the sewage from individual houses is extremely fresh and there is no opportunity for the mechanical breaking up of the larger suspended particles as is the case when sewage flows for miles in a city sewer. Then there are extreme fluctuations in the rate of flow in the case of the single house, as compared to the more regular discharge from a municipality. For instance, there is rarely any flow during the night, and the flow during the day comes in sudden rushes.

The small actual size of a house sewage tank, although it may be large from the standpoint of "hours of storage," may permit a sudden inrush of sewage to stir up the entire contents, thus carrying out some solid matter and causing the filters or the sub-surface system to clog. The above mentioned facts show the necessity of designing both tanks and finishing treatment on a more liberal per capita basis than is required with municipal plants.



RESIDENTIAL SEWAGE DISPOSAL PLANT.
3. Plan and Section of Sub-surface Absorption System and Under-drains to Remove Ground Water.

Finally, residential plants are intended to be more automatic than municipal plants, and rarely receive regular attention, and they must, of necessity, be located much nearer to dwellings than city plants. It is necessary, therefore, to exercise much more care in design in order that no work need be done on the plant oftener than once a year, although it should be inspected every few months. Also the design should be such that the plant will create no odors even though within a few feet of a residence.

Relative to the cost of building an efficient residential sewage disposal plant for a family of five or six, this will vary greatly according to the local cost of material and labor and the character of the ground in which it is to be placed. The usual tanks with sub-surface absorption system should be built in porous ground for $100 to $150; and in clay soil for $250 to $300. A plant including a covered sand filter may cost $500.

Wood Block Pavements from Construction Standpoint.*

By Day I. Okes, The Kettle River Co., Minneapolis, Minn.

I AM PRESENTING to the society a few observations made on the construction of creosoted block pavements noted from results of the material in place.

The foundation to be used under creosoted block pavements depends upon the sub-soil and the traffic strains to which the pavement is subjected. If there is good drainage of sub-soil, that is, if it is sandy or contains gravel, no provision needs to be made to allow for the effect of frost or heaving of the foundation. If the sub-soil is clay, or practically impervious to water, either sub-drainage has to be provided or an additional depth of concrete.

The effect of traffic on the depth of the concrete is proportional to the weight of the loads carried by the pavement surface. The strain on the foundation concrete is indirect compression, and the strength of the concrete mixture under compression determines the depth of foundation from this standpoint.

On almost all pavements it is necessary during the life of same to make openings or cuts for underground work or repairs. Unless this work is replaced in first-class shape there always results a deterioration of the pavement on the surface. In order, after cuts are made, to provide as strong a foundation as originally laid, it is advisable to reinforce over cuts or openings by an extra thickness of concrete or by steel reinforcements. Inasmuch as it is generally impossible to get the sub-soil in a trench replaced to its final compression the concrete foundation over the trench or cut would necessarily have no support in case the sub-soil took a shrinkage after the concrete was replaced. This would put the concrete foundation over the trench in tension, and the necessity of steel reinforcement is apparent.

As the success of a creosoted block street is dependent upon a continuous smooth surface, it is essential that the concrete foundation surface have as near the contour of the final pavement surface as possible. Where gravel concrete is used it is advisable to have the concrete foundation surface made by drawing a template over same. Where stone concrete foundation is used a template curve ought to be worked, too.

The cushion upon which concrete blocks are laid should never exceed 1 inch, and it should be less, either ¾ or ½ inch, where concrete is templated to an even surface; in fact, the use of the sand cushion under creosoted block streets is essential only in order to obtain a smooth wearing surface of creosoted block pavement.

Sand is now generally designated for the cushion material. Where there is vibration of pavement, as between car tracks, it is most advisable to use a mortar cushion. The manner of placing this cushion is to mix the sand and cement in proper proportions, dry, and pull same with template in a similar manner to pulling the sand cushion. The blocks are then placed and rolled to the final surface contour, then the pavement surface is flushed with water in order to dampen the mortar cushion, and leave same set up. After pavement becomes dry the filler can be applied.

It is my opinion that where the sand filler is now used with a creosoted block pavement under heavy traffic, the mortar cushion, such as above, would be very desirable in its place, inasmuch as the set in this mortar cushion would prevent any washing due to water leaking through the interstices of the blocks, and would also prevent any displacement of the block surface due to the pushing away or flowing of cushion, and the consequent rutting of the blocks under heavy loads.

The objection, of course, to this mortar cushion is the time necessary to wait for set before pavement can be used. However, it has the advantage of making possible the use of the sand filler on lighter traffic streets, inasmuch as it provides against the washing away of the cushion during the ironing out of the pavement and the sealing of the joints, and we who are somewhat familiar with the present creosote block construction know it is most advisable to do away with the kind of a bituminous filler which becomes sticky in hot weather.

This question of the kind of material to be used for the cushion and the kind of material to be used as a filler between the blocks, and the essential necessity of having a creosoted wood block pavement perfectly smooth under the various traffic and weather conditions brings us directly to the problem of the expansion of creosoted blocks and the necessity of providing against such expansion in order that the material will lay continuously as it is originally placed. On these premises we have two methods of meeting the problem of obtaining a practically smooth, continuous and permanent surface: First, to produce a block of

*A paper before the Wood Preservers' Association.

the kind of wood and the kind of oil, and with the required impregnation to allow a minimum percentage of absorption of moisture under conditions where the water or moisture surround entirely the creosoted block, or else to provide by construction a sealing of the creosoted blocks on the bottom by a mortar cushion, and on the four sides by means of a bituminous filler.

I do not wish to enter into the discussion of a satisfactory oil or treatment to be used for creosoted wood block paving, but I take up the problem from a contractor's standpoint. We are familiar, though, in a general way with the trouble that has been experienced during the use of a heavy or, as it is called, a "waterproofing" oil by the bleeding of the blocks. It is sometimes contended that this bleeding is due to the manner of treatment and to the action of the blocks expanding in the street. However, when the use of a lighter oil under 1.10 sp. gr. was prevalent, it is a fact that we did not experience trouble with the oil exuding and staying on top of the pavement, so that if we would use a straight run creosote oil and by our construction provide against absorption of moisture, and therefore against expansion by the use of a dry mortar cushion and a bituminous filler which would not cut back by the oil from the blocks or would not soften and run in the hot weather—that is to say, if an asphaltic base bituminous filler were used, we would have a minimum amount of expansion and movement of the blocks in the street, and therefore would provide a pavement which, if laid smooth, the original contour would remain in such condition under traffic and weather conditions.

As to the laying of creosoted blocks, it is now practically conceded by watching the action of same that it is necessary to place the blocks at an angle of 45 to 67½ degrees with the curb to provide against the wearing of the joints by the calks of the horses' shoes and also to get the action of any expansion of the blocks as near directly against the curb as possible.

There are many special problems of construction that arise in the laying of creosoted block pavement, those of properly caring for surface water, construction around manholes and intakes and street car work being the principal ones. As creosoted blocks are comparatively a high first cost pavement, it is essential that the proper study and care be given to the design, methods and workmanship, so that the resultant economy due to the long life of properly constructed creosoted block pavement will be attained.

Bitucrete Pavement.

By A. E. Schutte, Cambridge, Mass.

THE automobile and the astonishing demands its increasing use are making upon the paving engineer have rapidly come upon us, still there has been time at least to dispel two illusions which beset us at first. One of these was the insistent cry of the motor enthusiast who prophesied the immediate doom of the horse and his speedy elimination from our roads. We now know this to be a fallacy. We see traffic and business necessities so increasing with our greater population that there is work for all the horses and motors, too, that we have. It is not strictly the motor road which we must pave and keep paved, but it is a double purpose road which is required, and this brings us to the second fallacy that I mentioned, which is the ill-considered notion that horse traffic and motor traffic destroy a road surface in like manner, but in varying degrees, as was at first assumed.

An appreciation of the different forces of disintegration exercised by the horse and vehicle and by the automobile clearly shows why the old pavements cannot and will not stand either the automobile traffic or the mixed traffic. A horse going over the pavement and applying its hoofs upon the surface at first tends to compress the material below it and then by raising the hoof to kick some of it up, while the wheels tend to restore the whole to its original position by compression and by forcing some of the detritus back into the spaces or openings thus formed. A different force is exercised by the automobile. The fast going wheel first tends to throw the particles to either side of the tire and displace them, then the receding tire, forming a partial vacuum, draws the fine particles of the surrounding area, which are then forcibly thrown off by the centrifugal action of the wheel.

There are two different and distinct problems involved. Engineers have realized these facts for years and have found that they could construct a piece of roadway which would stand ordinary traffic, also that they could construct a piece of roadway which would reasonably well stand the action of the automobile, but the pavement which had to stand both kinds of traffic was a much more difficult thing to construct, and is still in its experimental stage.

The two main difficulties are to construct a roadway at reasonable cost which will prevent the automobile from drawing up and out the particles of material, of which the pavement is composed, and which at the same time will not suffer from the grinding, pounding and displacing action of the horse's hoofs.

Attempts to regulate the speed of traffic below the point injurious to the roads or to prohibit attachments to wheels which tended to hasten its disintegration were of no avail, for roads have to be built to resist the traffic no matter of what kind, and not traffic regulated to suit the road, which would retard progress in every sense of the word.

The first thought was to bind the particles, say of an ordinary macadam road, with a cementing material that had more cementing power than the ordinary detritus, by adding or pouring some more or less viscous material, and you all know the result achieved by any of the very numerous coatings which have been applied for five or six years upon the road surface and which, with occasional exceptions and under unusually favorable conditions last only a short time, this being principally due to the inability to incorporate the oils or viscous cement with the detritus in such a way that the resulting mixture will adhere to the stone, whose superficial voids the detritus is filling.

It is quite obvious why the road builder should turn to Portland cement as the material from which to construct his road, for in that cement he has the rigidity necessary to maintain the contour of the road and also the necessary cementing properties to hold the particles tightly together and thus prevent their dislodgement. Cement roadways, however, have proved unsuccessful on account of their hardness and lack of resiliency.

In 1906 the writer's attention was called to a compound which was placed on the market for the purpose of waterproofing Portland cement. It was composed of a very soft bituminous cement to which had been added some silicate of soda in order to harden the cement, whose strength was greatly reduced by the addition of the oil. A large number of experiments were made by the writer attempting to produce a combination of Portland cement with an oil suitable for roadways, but in each case it was found that the strength of the cement was reduced from 40 to 65 per cent. (depending on the oils used) and that a surface was produced which was weak; and slippery on account of the presence of the oil. After many trials this was abandoned, for if enough oil was added to make the surface slightly elastic the strength of the mixture was reduced below the utility point, and the resulting surface was exceedingly slippery and dangerous on this account to both the automobile and the horse. If only a small amount of oil was used the strength of the mixture was reduced without adding anything at all to the utility of the mixture as a roadway surface. The results and the knowledge gained through these experiments are, however, of much greater value to the water-proofing engineer than to the road builder.

The experiments in the mixture of oils and cement were abandoned and in 1906 and 1907 experiments were made to produce upon a rigid cement support an elastic, non-breaking surface, which should make it easier for horses, non-absorbent and silent. The experimental pieces, some of which proved successful, all showed in some places lack of adhesion between the Portland cement and the coating. This caused the material soon to be broken up and carried away. Numerous oils were tried for cementing the bituminous cement to the concrete but these experiments were accompanied by only partial success.

Late in 1906 a successful piece was laid, in which the surface of the Portland cement concrete, which was of the proportion 1-3-6, was carefully washed while still in its plastic condition so as to remove all the mortar between the upper and superficial stones and to produce between them spaces ranging from one-half to one inch, or thereabout. This was then flushcoated with the bituminous cement, which firmly stuck to the clean stone. This section of the roadway is still in existence today and is giving good results.

In experimenting with the latter, "protected concrete," as the writer termed it, a great difficuty was encountered in constructing this road in cold weather. It was almost impossible to make the bitumen stick to very cold stone and methods of heating the stone by means of surface heaters or burners were found to be too expensive for large areas. Solvents added to the bituminous cement helped but little.

The next advanced step was the produc-

tion of the Bitucrete double bond roadway, to which I wish to especially call your attention.

The method of constructing this roadway is as follows:

Upon an ordinary sub-grade, of no matter what kind, whether an old macadam road, dirt road, excavated soil, sand, or in fact anything capable of supporting wet concrete, there is placed a layer of concrete from two to six inches. In cases of resurfacing old macadam roads, the roadway is scarified, the detritus washed off the stone by means of hose; a thin layer, say one inch to two inches of stone is laid on the top and the whole grouted to form the foundation. While this foundation is still plastic there is placed upon it the "bonding course" so called because it is firmly bonded to the foundation and because it holds or bonds the particles of stone as well as the filling bitumen in its spaces. This bonding course is preferably composed of a uniform sized stone about one inch in diameter (preferably of a size which will pass 1 inch and remain on ½ inch ring), which has been previously coated by any suitable and economic means with a Portland cement grout composed of preferably neat Portland cement and water or Portland cement containing a small addition of fine sand. Mixing has been found the best for this method, and this mixing can be done either by hand or by machinery.

It is quite possible to coat these stones by spraying or forcing grout upon and into them, the main object being to surround each inidividual particle of stone with this mortar or grout so as to produce around the stones a continuous layer of Portland cement which is somewhat heavier at the contacting points of the individual stones. Thus you can see there is formed a well of stone and Portland cement which keys all the stones together and at the same time leaves between the stone interstices or voids.

After this layer two or three days old, or has become sufficiently hard, there is poured upon and into it a tough bituminous compound which fills all the voids and leaves a layer on the surface into which there is then first incorporated some stone about one-half inch size which sink into the spaces between the projecting stones and then there is scattered over the top a thin layer of sharp gritty material which produces a non-slippery surface. For this top layer either coarse sand or crushed screenings is used.

Here we have each individual particle of stone first firmly secured, cemented and bound to the adjacent particle of stone and in turn to the foundation, making displacement of these stones very difficult, and here we also have a non-abrading bituminous surface which fills the voids between the stones, prevents the abrasion of the stone, and is prevented from being displaced by the stone (they taking all weight), and which produces with these stones a waterproof, non-absorbent, semi-elastic surface, which can be made as rough or as smooth as the conditions, or rather the engineer, may require. A pavement thus results which has enough bitumen to perpetually and continually coat the points or surfaces of such stones as may be exposed by wear and which also can be very easily repaired in case the necessity for cuts arises.

Another advantage is that it does not require special machinery for its laying, although like all important construction the work must be done carefully.

An ordinary concrete mixer, good cement and fairly hard stone, tough bitumen and reasonable care in construction is all that is necessary to produce a successful pavement of this kind. It is important to keep the surface as clean as practicable before the bitumen or filler is poured into the bonding course, for dirt, sand, etc., will prevent the bitumen from penetrating.

It has been found that in order to secure a proper setting of Portland cement and keep it clean, it is best to cover the area laid each day with canvas until the proper time for pouring has arrived, thus preventing the Portland cement from being dried before setting, and also preventing infiltration of dirt or detritus in case of rain.

A test piece was laid at Cambridge, Mass., over two years ago, over which about 118,000 tons of material, generally in loads of 2 to 3 tons, has been hauled. After the pavement stood this test a piece was laid for public use at Newton, Mass., and now some 18,000 yards are being laid at Morristown, N. J.

During the laying of the Morristown work the pavement had two rather severe tests, the first being the carting over it of a sand-stone column weighing about 14 tons, supported on a wagon with three-inch tires, and the second a 50-ton manganese steel vault on a twelve-ton truck weighing altogether about 62 tons, drawn by 24 horses, of which about 2,360 pounds per square inch was on the hind wheels. The load was drawn the entire length of the pavement when it was only ten or twelve days old and it stood these excessive tests without showing the slightest mark. At one stop the heavy load stood nearly one-half hour and the horses started the load without any special effort leaving absolutely no mark where the wheels had stood.

Paving and Care of Streets.*

By Edwin A. Fisher, City Engineer, Rochester, N. Y.

GUARANTY.

MUCH has been said and written upon the subject of pavement guarantees. A few years ago a long guaranty was thought to be the one thing needful in street paving. New York City laid many pavements under a fifteen-year guaranty period. Many other cities, unless prevented by charters, exacted ten years. Of late, however, a reaction has set in and many engineers and other municipal officers argue that the guaranty should be abolished entirely. I believe that some guaranty is essential, but that it should not cover an extended maintenance, but be limited generally to the material and workmanship.

Where a large amount of underground work is done, scattered, as is usual, over a considerable distance, it is absolutely impossible, with ordinary inspection, to know that the trenches are properly backfilled. The contractor should be responsible for this work.

We have fixed the guaranty period for standard pavements at five years, and for resurfaced streets and sidewalks at three years. I do not think a uniform length of guaranty of all kinds of pavements is right. It ought to be only long enough to detect defects of material and construction and should vary with the different kinds of pavements, and other conditions. I recently told a committee of citizens that any contractor who would sign a contract with a maintenance guaranty for a macadam pavement on a street of considerable traffic ought to be sent to a lunatic asylum.

CONTRACTS.

Two methods of letting contracts are practiced—the lump sum bid and the unit price bid. If the exact quantity and character of the work can be fully and clearly described, and changes are not probable, the lump sum is the most satisfactory. On the other hand, as is usual in the case of a permanent pavement, especially in the older portion of the city, where many of the quantities are not positively known, the unit price method is preferable. I have used this method altogether for pavements. What is wanted is a method that will eliminate the gambling element and enable the engineer to pay the contractor a fair price for satisfactory work. Care should be exercised, however, in making up the bidding sheets that the estimated quantities correspond as nearly as possible with the actual, else you will get unbalanced bids. I have found it better, in the case of items where the quantity was uncertain, to fix the price in advance, or leave it out altogether, and treat such items as extra work, rather than to put in estimated quantities which might vary materially from the actual, and thus tempt the contractors to make unbalanced bids.

LOWEST BIDDER.

The charter provision compelling the letting of all contracts for public work to the lowest bidder that will furnish adequate security results, in many cases, in turning over municipal work requiring special knowledge and skill to ignorant or inexperienced men, deficient in every quality required for the successful execution of the work. Nothing has so tended to bring the business of municipal contracting into disrepute as the lowest bidder. From a large experience in both public and private work, I am clearly of the opinion that the contracting board should have discretion to let contracts as in its judgment is for the best interests of the municipality. In nearly all cases the lowest bidder would get the work. Honesty, ability, intelligence and special knowledge would be recognized, and the business of the city contracting be placed on a higher plane. The work would also be better and more economically done.

For twenty-five years prior to the year 1900 municipal contracts for the city of Rochester were let by an elected board of three members having authority to award contracts as in its judgment was for the best interests of the city. While this board, on account of its large powers, was made the central figure in every municipal campaign, and all sorts of criticism and abuse heaped upon its members during the heat of a campaign, I do not recall that its acts, with respect to the letting of contracts, were ever questioned.

ASPHALT.

This pavement leads all others in amount laid in the larger cities. It possesses most of the qualities of an ideal pavement, and taken altogether, when properly built and maintained, and laid upon streets adapted to its use, is generally satisfactory. It is easily repaired, even when worn quite thin, and in this respect is in contrast with block pavement of any kind.

Many mistakes have been made in the

*From an address before the Williamsport, Pa., Board of Trade.

past in an endeavor to cheapen the cost of this kind of pavement.

BITULITHIC.

Mention may also be made of the bitulithic pavement that has come rapidly and extensively into use in the last ten years. This pavement is correct in theory, and its extensive and generally satisfactory use indicates that its theory is sustained by actual practice. It combines very many of the qualities of an ideal pavement. Its success, however, depends, more than any other kind, upon extreme care in the selection and grading of the materials, and in the proper execution of the work. It is therefore perhaps an actual advantage that its use is covered by broad patents, preventing its construction except under the skilled supervision of the patentees.

STREET RAILWAY TRACK.

The general railroad law, as interpreted by the Court of Appeals in the Conway case (a Rochester case), compels street surface railways to keep in repair the pavement between lines drawn two feet outside the outside rails of the tracks in any street, and also to make new pavements within the same space when required by the proper authorities, and within thirty days from the date of notice so to do.

The Rochester Railway Company has, since the court decision referred to, waived the thirty-day notice and permitted the city to let the contract in the railway portion with the remainder of the street. Our present charter permits the city to assess the cost of this work upon the property and franchises of the railway company.

Two methods of construction are followed: Wooden tie construction, consisting of a concrete foundation twelve inches thick, extending the entire width of the space, between lines drawn six inches outside the outside ends of the ties, put in at the same time and connected with the six-inch foundation outside. Wooden ties about two feet six inches centers are left imbedded in this concrete. This form is favored in streets where recent excavations have been made under the track space.

The other method, and one now practiced, is the use of steel ties of three inches depth, spaced four feet centers, imbedded in a twelve-inch Portland cement concrete foundation, extending entirely across the space between lines drawn six inches outside the ends of the ties and connected with the six-inch foundation under the pavement. Old rails have been used for ties in some streets.

Anchor Ice.*

By Linden C. Trow, Superintendent of Water Company, Lake Forest, Ill.

WHEN a period of about six months has elapsed after a young man has paid his first ten dollars on a correspondence course in hydraulic engineering, and has secured a position with some water company, he signs his name John Smith, Hydraulic Engineer, spelling the last two words out in full; but having had some fifteen to fifty years of experience along these lines, he signs himself just plain John Smith, his eyes having been opened to so great an extent to what this field of engineering covers that he doesn't feel as though the ownership of the term is his sole property.

Two years ago, I sent word to this Association that I would deliver a paper upon the subject of Anchor Ice, but at the present meeting, I would rather simply ask the question, "What is Anchor Ice?"

The severe winters in the region of the Great Lakes have always affected the water supply to so great an extent that it has become a custom to couple the ice question with problems relating to an adequate water supply.

Of course, a shut down of one minute is an unpardonable occurrence in the eyes of the consumer, and keeping this point in mind, consider the effect of a five-hour shut down and a shortage of water at breakfast time.

In different countries, ice which causes a stoppage in the intake is known by different names. In Scotland it is called ground gru and lappered ice; the French Canadians call it moutone from its resemblance, after accumulation, to the wool on the back of a sheep; others call it spicular ice, but the name of frazil given by Mr. Murphy in his report to the Royal Society of Canada, is the one most generally used along the northern lakes. Anchor ice is the common expression in the United States and, although it is in reality misnamed, it is such a handy phrase that it will probably remain in spite of any efforts to credit frazil with the record it has made, and were you to tell a consumer that you had frazil, when he wanted to know why he couldn't get water, he would probably think that you

*A paper before the Illinois Sanitary and Water Supply Association.

had partaken too freely of some new breakfast food.

It is doubtless well at this point to state that men who have made a thorough study of ice formation, divide the ice into three classes, first sheet ice formed upon the surface; second, anchor ice formed upon the bottom; and frazil or ice formed below the surface and above the bottom. Anchor ice and frazil are both formed only when there is open water above. Along the west shore of the lake there are a few other features which are always stable; the wind must be in a westerly direction and the thermometer must be below freezing. Frazil or anchor ice is never formed when the sun is shining or when there is a cloudy sky at night, and the rising sun always heralds the fact that the accumulation of ice has ceased. The very slightest rise in water temperature relieves the situation and the ice will loosen its grip if the water is warmed to the thousandth part of one degree on the positive side of freezing.

Anchor ice is formed upon the bottom of rivers or bodies of water where the water is in motion; the growth of frazil is in the water itself, and the necessity of some object being present for it to attach itself to is eliminated, as the floating particles will adhere one to another. The growth of frazil must be accompanied by surface cooling through wind or rapid agitation and by radiation.

In questioning men of practical experience, it is very interesting to note the different theory which each one advances as to the cause of the ice which closes an intake and the theory of one man will possibly be an absurdity in the eyes of the next man as compared to his own. One engineer advanced the following: "It is a law of nature that warm water must rise, also a law of nature that objects lighter than water must rise, hence it stands to reason that water at the bottom of the lake is the coldest and that is the point where the ice is formed and from there having become lighter by the process of freezing, it floats to the surface unless drawn aside by some disturbance in the water such as an intake, whose suction causes the ice to adhere to the screen in the form of minute crystals until the screen is so thoroughly covered as to stop the passage of water." This theory is only handicapped by the fact that the rapid circulation of water ceases when the theormometer reaches 39 degrees F.

Another is this: "In 1836 Gay-Lussac observed that water, when placed in a vessel covered with oil, may be cooled to 10 degrees F., without freezing, but if the vessel is shaken, solidification ensues at once. During a west wind the water at the surface is always warmer than at the bottom, and this warm water upon the surface may act as a blanket in some such manner as the oil, and the water reach a point below freezing until disturbed by coming in contact with the intake."

In one city north of Chicago, I found a 42-inch intake with thirteen openings, some pointing up, some pointing down, and others pointing at different angles; for there is a theory that the way which the opening looks makes considerable difference; some of the openings are covered with iron screens and some with wooden screens, but in spite of all these precautions, this city's intake was closed by ice this winter to such an extent that it was necessary for them to send a diver down to make an opening. Some one connected with the welfare of this city, conceived the novel idea of placing a fan over an opening in the intake to be propelled by compressed air which would keep away the ice. The engineer and commissioner of public works spent a few peaceful nights in sleep after this installation was made, but one night the water ceased to come; the diver was hurried to the scene and lowered to the bottom to discover what had gone wrong with the fan, and there over the intake he found it churning away, completely housed for the winter in a dome of ice.

Of the theories advanced by practical men, or the man at the throttle, many will be seen to be very near the truth of the situation, but it still remains for such institutions as our State Universities and other organizations of research to get at the whole truth of the matter.

The usual method of procedure in a case of anchor ice is for the night engineer to call the superintendent out of bed about 12 o'clock and tell him that "there is a valve out of the pump." When asked over the 'phone "which end," his confused reply is that "there seems to be one out at each end, both sides." Crawling into his clothes the superintendent proceeds to the pump room to find the hand of the vacuum gauge reposing peacefully upon the pin. The valves in the well are closed and any pressure which may be left in the mains is thrown upon the intake through the bypass. At times we have been able to maintain a pressure of seventy-five pounds upon the intake for fifteen or twenty minutes before there would be any noticeable release. About one out of five times, this method, when tried before sunrise, has proved satisfactory, the other four times, more water was lost back-flushing than came back before the ice again closed the opening. The pumps usually get a full supply of water with the aid of nature's remedy, the heat of the sun, about as soon as the plant that labors with back-flushing and other contrivances.

A New Elevator Grader for Road Building.

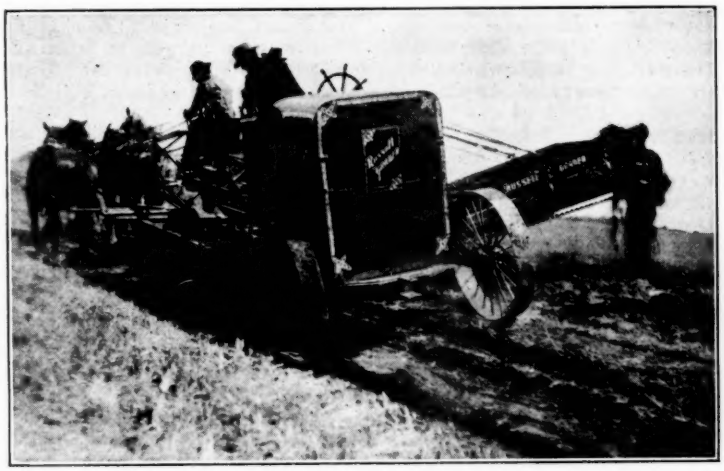
By Frank C. Perkins, Buffalo, N. Y.

THE accompanying illustration shows the method employed in building roads in North Dakota, with an elevating grading and ditcher of an English design as constructed at Minneapolis, Minn.

The gasoline engine is utilized for handling the material, the elevating grader throwing a large furrow with four or six horses as a motive power. The photograph shows the machine in operation handling Red River Valley gumbo. It is moving more earth than could be handled with from 12 to 16 horses on a geared machine without the use of a gasoline engine, the latter in this case being covered by a metal casing. It is interesting to note the comparison in Fig. 2, of a road machine of the reversible type in service on street work at Los Angeles with the engine driven grader and ditcher noted in illustration Fig. 1.

The gasoline engine for running the carrier is compact and powerful and arranged to be speeded up to make the carrier belt run faster in elevating loose material. The grader is capable of moving 1,000 to 12,000 cubic feet of earth in 10 hours actual work, saving one-half the expense of other methods formerly employed.

This motor-driven elevating grader is



1. BUILDING ROADS IN NORTH DAKOTA WITH AN ELEVATING GRADER AND DITCHER.

2. REVERSIBLE ROAD MACHINE ON STREET WORK IN LOS ANGELES.

utilized extensively for building and repairing irrigation canals in the arid land of the West and for rice culture of the southern states, as well as for building drainage ditches throughout the Red River valley of the North.

The carrier or elevator consists of a belt of 36 inches wide which conveys the dirt from the plow by the gasoline motor, the machine and plow being hauled by horses, giving a combination which serves to reduce the expense very materially, as it will be admitted that about as much power is required to operate the carrier loaded with dirt as to haul the plow and machine in ordinary soil.

The advantages to be gained by hauling by animal power are that there are no drive wheels and the grader does not depend upon driver or bull wheels for power to convey the dirt. It is maintained that wet or loose ground will not prevent it from elevating and a small rain shower will not lay up the work, as it will elevate and do good work in wet or sandy soil as long as it is passable to the horses. When a carrier 18 feet long is utilized, an engine of from 8 to 10 horse-power is required, the motor being increased to 15 horse-power capacity when a 23-foot carrier is utilized. The latter may be reduced to 18 feet in length by removing a 5-foot section if desired.

The carrier is made sectional and can be made adjustable to various lengths, but when a carrier as long as 30 feet is required, an engine of 20 horse-power capacity must be used.

Maintenance of County Roads.*

By Robert E. Gibbons, County Engineer, Terre Haute, Ind.

I WISH to call the attention of our society to a condition regarding the maintenance of our improved county roads which is becoming a very serious factor in our county and no doubt in all other counties throughout the State.

These roads were originally built by the townships, subscription and in a few instances by the State and government, and some few were started as toll roads. These as a general rule were and are our most heavily traveled roads, and those which were in a somewhat respectable shape were taken over by the county several years ago and have been maintained by the county since being taken over.

This maintenance, as we all know, has never been what it should be, this being not so much the fault of the officers directly in charge as in the lack of available funds to carry on the repairs in an adequate manner, the custom being to appropriate sufficient money during the September meeting of the County Council to take care of the road repairs for the following year, and despite the pleas of the county commissioners these items have been shaved so close that as repair funds they are a joke. To my actual knowledge one of our later gravel roads this year had $8.00 per mile for maintenance.

These highways, as a general rule, were built in a fairly substantial manner, and from the fact that they stand the wear and tear which they are subjected to for from five to ten years, with practically no care nor maintenance, where originally constructed in a reasonable manner, clearly shows that the life of the road could have been easily doubled or tripled with intelligent care in the repairs and maintenance.

But the point I wish to make is the fact that the older roads are the heavier traveled, and with our present motor traffic and greatly increased freight tonnage, they do not answer the purpose, and, taking into consideration their maintenance, or so-called maintenance, they are not, as a general thing, a subject for repairs, but for rebuilding. Not alone the wearing surface, but the gradients are excessively heavy, and the subgrades, drainage, culverts and pavement should be thoroughly remodeled and the highway rebuilt to get the proper roadway for modern conditions.

In our county—and, I suppose, in others—our recently constructed roads are, as a general rule, crossroads and byways leading to the main highways, connected with the county seat and with other larger cities, comprising our markets and business centers. These roads are by far better constructed in all ways than the principal highways, the result being that the nearer the city the poorer the road; and as our motor business or traction and pleasure or joy riders usually travel from one large center to another, they do not touch the better roads, except in the lesser populated counties, where road construction is prac-

*From a paper before the Indiana Engineering Society.

tically new and traffic light, and as this class of citizens form our best reporters, the consequence is that the whole highway system of the larger populated counties is condemned.

There is absolutely no way to take care of these county roads, except under the old repair method, which means that the road is never kept in good shape and steadily deteriorates from year to year, until, as in this county, we have a large mileage of supposedly improved highway which is very little better, if any, than our dirt roads, being saddled in addition with very heavy gradients, poor drainage and culverts.

Now, the only way to handle these worn-out county roads is not to repair, but to rebuild them to meet modern conditions; and as we have no legal way to proceed, under the rulings of our county attorney, it will necessitate legislation upon this subject; and if it becomes possible to pass a law covering the rebuilding of worn-out county roads, the law should, I think, if possible, cover the method and procedure in which these roads are to be taken care of after construction, although the latter being a subject upon which there is considerable chance for argument and widely different opinions, need not be embodied at present if it has a tendency to wreck the whole, although I think it is important.

I am also of the opinion that the act should, in the rebuilding of these old county roads, make the State as well as the county a party to the construction, and that both should bear their parts in maintenance after construction, and that the engineering department having charge of the work, whether they be county or state engineers, should be taken care of in an intelligent manner as to their duties and remuneration, as—and I think you will all agree with me—from $2.50 to $3.50 per day is hardly an attractive figure for a real engineer to jump at, although the road-law makers seem to think so, and they cannot understand why they do not get the same class of engineers and the same class of work which private corporations get who pay salaries and fees that somewhere near compensate the engineer for his work.

The Capitol Avenue Bridge, Indianapolis, Ind.

Editorial Correspondence.

INDIANAPOLIS is fortunate in possessing a number of very attractive bridges, which have been constructed over White River and Fall Creek, two streams which flow through the residential and park districts of the city and along which pleasure drives have been constructed. The most recently constructed of these bridges, one which is in fact not yet completed, is the Capitol avenue bridge across Fall Creek. Capitol avenue is a boulevard limited to pleasure vehicle traffic and the new bridge is at the junction of this avenue with the Fall Creek boulevard. The approach walls and rails join the lines of these drives in curves and are tangent to the curb lines.

By reason of its location in this important relation to the parkway system, particular care was exercised to secure a graceful structure which would prove consistent with and an ornament to the landscape features of the boulevards mentioned; and the result seems to fulfill the hopes of the park authorities in every particular. It was paid for by the county and constructed under the supervision of the Indianapolis Park Board.

The type of arch chosen was a modification of the Melan type; a seven-centered arch which joins the springing line tangent to a vertical line. The concrete which forms the body of the bridge is in no place visible except on the intrados of the arch. A granite facing on each of the piers and abutments and a Bedford sawed stone facing on the spandrel wing and approach walls and in the railings and posts adds greatly to the pleasing effect and the result is a graceful structure thoroughly consistent in every detail.

The center arch is longer than the two end arches, giving a curve to the entire bridge. The two end arches are each of 48 feet span with 8 feet 9 inches rise, while the main arch is of 84 feet span and has a rise of 11 feet 6 inches. The center arch is twenty inches in thickness at the crown while the two smaller arches are 12 inches. The resultant curve imparted to the roadway is parallelled by the railings.

The steel bridge, a double Pratt truss, which formerly occupied almost the exact site of the new bridge was removed early in June, 1911, and the center pier was left standing. Construction work was started by the contractors, The Cleary-Kuert Co., Indianapolis, on July 12th.

Excavations for the piers and abutments were carried down by cofferdams to a depth of 10 feet below low water mark and piling was driven to a depth of from 15 to 20 feet into the solid gravel which underlies almost the entire city of Indianapolis and forms the bed material in the small streams in the locality. A seal coat of concrete was then deposited into which the piling extended about 4 feet. Centrifugal pumps were operated continuously to remove the water which seeped through the gravel beneath the cofferdam. The seal coat was carried to a depth of about 2 feet below low water mark, where the granite face was commenced and carried to the springing lines of the arches.

The arch centering was of the ordinary type, as will be noted from the accompanying photographs taken during construction. Pile bents were constructed and caps were set on these, then the adjusting wedges were placed and other caps superimposed. On these rested ribs spaced 45 inches on the large and 32 inches on the small arches. The lagging, accurately sawed from 2-inch lumber, was placed on these. In laying out the curves for the forms, a pattern was marked out on the asphalt of the boulevard by accurate transit points and the material was cut to conform. The surface of the forms was carefully dressed and oiled with paraffin so that the under surface of the concrete is smooth and shows few joints. It is interesting in connection with the form work to note that about three months after the concrete had been placed in the arches, in January, 1912, a flood and floating ice carried away part of the centering and loosened the wedges on some of the other so that the arches were all practically unsupported from that time.

A very efficient plant was installed for placing the concrete. In dredging out the creek bed at an earlier period, an amount of excellent fine gravel had been excavated and dropped on the north shore of the stream. The mixer plant was set up on the roadway at this end and an inclined trackway with switches at both ends was run down to this gravel bank. Cars operated by a drum integral with the mixer and operated by the same engine were put in service to bring the materials to the mixer. The cars were run down by gravity to the gravel pile, receiving on the way the portions of cobble stones or coarse gravel required, and the cement. Then after the addition of the finer stream gravel they were hauled back to the mixer and dumped into it. The mixer discharged into a dump bucket suspended from a derrick at the north end and from which it could be passed to a derrick located on the center pier of the old bridge and thence to a derrick on the south bank or could be placed intermediately. A temporary trackway was also constructed, by means of which cars could handle the concrete for the longer distances. The plant handled on the average about 21 cubic yards per hour. A ½ yard batch mixer was used. A 1-3-5 gravel concrete was used in the substructure, while the arches were built of a 1-2-4 broken stone mixture. About 5,200 barrels of cement were used and the last concrete was placed before the period of very cold weather. Provision was made whenever

CAPITOL AVENUE BRIDGE, INDIANAPOLIS, IND
North End, Showing Plant for Handling Concrete and Concrete Materials.

the temperature was below freezing, to heat all the materials, to use hot water, and the concrete was heated by steam pipes for a period after placing.

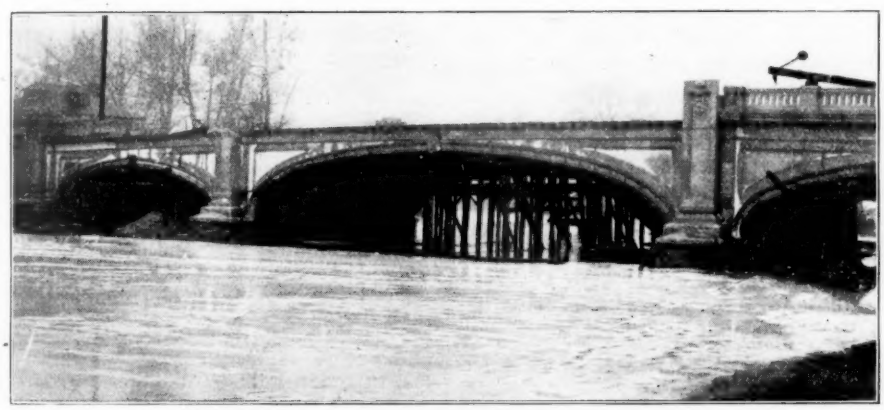
It will be interesting to note the success of the waterproofing materials used as a compound which was mixed with the cement was used on the south arch while the other two were coated with a mineral and oil mixture which was painted on the surface. La Farge cement was used where the concrete joined the stone facing, to prevent staining. It was also used in pointing up all the stone work.

The Bedford stone facing possesses many novel features of construction and the care exercised in dressing and preparing it was such that there was not the slightest trouble in putting it in place.

dled by the system of derricks mentioned in connection with the concrete, with the one difference that the center derrick was placed on the newly completed middle arch, for the reason that the old bridge pier had been removed. The second photograph shows the placing of the stone.

The lamp standards shown are of special design prepared for this bridge. They are of heavy cast bronze construction and will support five ball globe lights placed erect.

The roadway over the bridge is forty feet in width and was to have been paved with wood blocks, but the decision of the Park Board to make the pavement material the same as the north extension of Capitol avenue, which will probably be of asphalt, makes a change probable. There



CAPITOL AVENUE BRIDGE, INDIANAPOLIS, IND.
South End, Showing Centering and Completed Arches Without Parapet.

The hollow panels which form the small railing posts, were formed by carefully drilling three holes in a vertical line, of the radius of the top and bottom curve. The intermediate portion was then sawed away, leaving the panels as shown. The posts were all slotted to the depth of about 6 inches and the panel blocks and railings were dropped into accurate position, the railings being mitered into the caps of the posts, with the result that there is a perfect alignment of the railing throughout; though the posts extend slightly beyond the railings and the main posts of the columns slightly beyond the line of the intermediate posts so that in no case is there an unbroken straight line of sight. The rail is at a distance of about 44 inches above the sidewalk line so that it will be easily possible for one to rest his elbows on the top while standing on the sidewalks. All the stone was han-

are ten-foot walks on either side, which will be constructed of granitoid. Conduits will be placed on both sides with convenient manholes for the accommodation of all wire lines. The seepage water is taken care of by red tile lines placed between the arches and communicating with pipes in the piers which discharge at about two feet below low water.

The contract price of the structure was about $85,000, though a unit price clause will probably increase this amount to some extent. The construction work was under direction of the Park Board who were represented on the job by L. V. Sheridan. The design was made by George E. Kessler, who is consulting architect for the Park Board, for whom H. B. Boardwell acted as architect and R. C. Barnett as engineer in direct charge of the design.

EDITORIAL COMMENT

California's Public Utilities Act. — The County Jungle. Financing Road Building.

CALIFORNIA'S PUBLIC UTILITIES ACT.

The State of California has had the opportunity to prepare a law providing for the regulation of public utilities of all sorts, in such manner as to take advantage of the experience of all the other State commissions, and all the formal steps leading to the law which went into effect on March 23, 1912, were taken during 1911.

California has had a railroad commission for over twenty-two years, having power to fix rates and prescribe a uniform system of accounts for transportation companies. In March, 1911, the legislature voted to submit three constitutional amendments to the vote of the people which would make it possible to give the Railroad Commission more power and to extend this power over the other public utilities in the state. These amendments were adopted by vote of the people on October 10, 1911, the bills putting them into effect were introduced at an extraordinary session of the legislature on November 28, and they were duly passed by both houses and were signed by Governor Johnson on December 23, 1911.

The bills were drafted by the attorney for the Railroad Commission, Max Thelen, after several months' study of the actual working of some twelve of the leading commissions of the country and of the statutes governing them, and cover the constitution of the commission, its powers and duties, the modes of procedure before the commission and the courts, the relations between the commission and public service corporations, both private and municipal.

There are five commissioners with term of six years, appointed in three groups of one, two and two, and salaries of $6,000 a year. Separate hearings may be held by the individual commissioners but their findings must be approved by the commission as a body before they become effective. The office is in San Francisco, but hearings may be held anywhere in the state.

The commission is given power, among others—

(a) To fix all rates, fares, charges and classifications.

(b) To establish through routes and joint rates, fares and charges.

(c) To investigate all interstate rates, fares and charges affecting this state and to apply to the Interstate Commerce Commission or to any court of competent jurisdiction for relief.

(d) To prescribe just, reasonable, safe and proper service, equipment, facilities and methods.

(e) To prescribe additions, extensions, repairs and improvements.

(f) To direct that additional cars or trains be operated and that trains stop with greater frequency and at proper places.

(g) To direct connections in proper cases, between the tracks of railroad or street railroad corporations.

(h) To direct, in proper cases, that switch connections and spurs be installed.

(i) To direct that physical connections and joint rates over two or more telephone or telegraph lines be established in specified cases.

(j) To direct the use, in proper cases, by one public utility, of a part of the property of another utility, on, over or under any street or highway.

(k) To direct the installation of safety appliances and other devices to safeguard the health and safety of employees, patrons and the public.

(l) To regulate crossings of railroad tracks and streets or highways in specified cases.

(m) To investigate the cause of accidents and to take steps to prevent their recurrence.

(n) To provide demurrage rules and

rules for the collection and delivery of express packages and telephone and telegraph messages.

(o) To fix standards, classifications, measurements and practices of gas, electrical and water corporations.

(p) To ascertain the value of the property of every public utility.

(q) To establish uniform systems of accounts for each class of public utility.

(r) To permit or refuse to permit new street railroad, gas, electrical, telephone or water corporations to enter a field already served by an existing corporation of like kind.

(s) To permit or refuse to permit corporations mentioned in (r) to exercise rights under new franchises or permits.

(t) To regulate transfers of the property used in the public service, of public utilities except express corporations, wharfingers and warehousemen, and the acquisition by one public utility of stock in another utility.

(u) To regulate and control the issues of stocks, bonds and other evidences of indebtedness within the state.

Hearings are held without regard for the technical rules of evidence with a view of ascertaining the truth as speedily and simply as possible. Any one aggrieved by a decision must first ask the commission for a re-hearing, giving his reasons for the same, and if it is refused he may then appeal to the State Supreme Court for a review of the question on the evidence presented at the hearing by the commission, without new evidence, the findings of the commission as to questions of fact being considered final.

The provisions for bonds filed by petitioners for review to protect those who would be injured by delay if decision is in their favor, and for impounding excess rates and fares at interest until the question of their validity is finally decided, seem to be ample and also in such shape as to prevent long-drawn out legal proceedings and appeals on slight grounds simply to secure delay.

Most cities and towns in California now have power to fix rates and fares charged by public utilities within their borders and some of them can regulate service, equipment, etc. These powers are continued under the new law. Another act provides that the people of any city or town through its council or by petition of 10 per cent of the electors can hold an election and turn the control of any of its public utility corporations over to the Railroad Commission.

One of the constitutional amendments restricts the control of the Railroad Commission to private corporations, thus leaving the municipally owned plants without control. In this California follows Washington, Oregon, Nevada, Kansas, Ohio and New Hampshire, and departs from the practice of the states which have commissions under laws producing the most satisfactory results, i. e., New York, Wisconsin, Massachusetts and New Jersey. If one may judge the future results in California from those already obtained in Wisconsin, for example, the cities and towns in California which have municipally owned plants will soon be very jealous of the better results obtained in the municipalities with privately owned plants under commission control. And it is quite possible that they will also be envious of the better market for the securities of the private plants, although the price of municipal securities is affected by other factors than the management of the utility for whose benefit a special issue of bonds is made. It is quite possible that the differences in service and rates will be so noticeable that the people will ask later that their own public utilities be subject to the same expert control that the constitution now provides for the privately owned plants. This depends largely, of course, on the efficiency and honesty of the State Railroad Commission, particularly of the first one, which has just gone into service.

The city attorney of San Francisco, Percy V. Long, has made a careful study of the effect of the new constitutional provisions upon the control of privately owned public service corporations by the municipality and has written an opinion in which he shows the entire change of principle made by the change in the constitution and the consequences thereof so far as San Francisco, at least, is concerned.

He shows that under the old constitution the public service corporations were practically free from municipal control, and that such corporations organized prior to October 10, 1911, continue to enjoy the same freedom, so far as they

had exercised their rights. He asserts that these privileges were revoked by the recent amendments and that no new corporation can do business except under the control provided for by these amendments, which is by the municipality or the railroad commission as above outlined. He also asserts that no old corporation can extend its operations in the municipality except under the control now provided for. His reasoning in this regard seems conclusive and if sustained by the courts will ultimately give the cities control over the older corporations, because their desire for the extension of their business into new districts will lead them to concede this control over all their business in return for the grant of the privilege of making the extensions. Cities can hasten this day by judicious treatment of each particular case.

Mr. Long differentiates very clearly in his opinion between conditions that may arise. Thus the distribution of power is not mentioned in the amendments to the constitution, but the distribution of light is covered. An electric light and power plant desiring to extend its lines in San Francisco could therefore extend them for the purpose of supplying power without other control than that of the physical structures under the police powers of the State, but could not extend them for the purpose of supplying light without accepting the municipal control of its operations which is granted by the new sections of the constitution and the acts of the legislature thereunder.

THE COUNTY JUNGLE.

This term is applied to the present form of county government in New York State, and a diagram, which attempts to show the relations of county officers to each other, to the state government and to the people of the county and state, gives rise to the term, for it has every appearance of a trackless jungle, or rather of one with a multitude of tracks with little or no relation to each other, such as would be made by wandering animals trying to get from one place to another without guidance or knowledge of direction or distance.

This showing is made in the February *Short Ballot Bulletin*, and is possible because of the headless nature of county government, the independence of the various elective officials and their consequent possible irresponsibility and lack of co-operation.

The National Short Ballot Organization is wedded to the commission form of government, and so it recommends a board of supervisors as the responsible head of the county government, which shall have the appointment of all the other county officers, and shall have both the tax-levying and revenue-expending functions.

One member of the organization, Richard S. Childs, recommends the appointment of county judges by the governor, they to appoint the officers of the court, such as clerk and sheriff; the appointment of the prosecuting attorney by the state attorney-general, who is made an appointee of the governor, he to appoint the coroner; and the appointment of the county clerk by the secretary of state.

This process certainly produces a short ballot, but it produces scarcely any other good result and wholly overturns present principles and methods. For example: At present the construction of the main roads in the state is in the hands of the state highway department, and it is quite necessary that the county and township work on the local roads be thoroughly co-ordinated with the work of the state commission. This is made possible by the laws, recently passed, which give the state commission close supervision over the county and township engineers and supervisors and over their qualifications and attention to their duties. While it is true that the county supplies funds for road construction and maintenance, and to that extent might make claim to a right to supervise these expenditures, it does not supply all the funds, and the knowledge by its board of supervisors of the subject of road making is limited and fragmentary. Far better results are therefore obtained through the expert supervision by the state commissioners. This is amply demonstrated already by results.

The principle of home rule does not suggest the proposed change in responsi-

bility of supervision, for the next proposition is to abolish the office of county auditor and substitute for him a state examiner with power to investigate and criticise county management, but not to interfere therein. The great value of control of county and municipal accounting by a state board has been demonstrated in Ohio, and therefore the proposal of a state examiner is a good one, but the proposed method of operation of the system is distinctly vicious, and opens the way to a system of blackmail which would be difficult to control.

Likewise the appointment of judges, prosecuting attorneys and county clerks by the governor or by his direct appointees is vicious in that it makes these offices the direct appendages of the state political machine. In other words, the proposed plan, so far as politics is concerned, simply transfers the political control from the county machine to the state machine, and the last state will be worse than the first.

It is possible to work out a short ballot scheme for the county which will concentrate responsibility for financial matters and for efficiency of county officers in a few hands. It is possible to work out a system of expert state supervision of matters concerning which most local authorities are confessedly ignorant, quite to the extent that they do not know that they are ignorant. And it is possible to do these things without interfering with the real, though as yet imperfectly recognized right of home rule. But the plan proposed violates so many of the fundamental principles of good government, and ignores so much of the information as to success and failure of the methods proposed and condemned, that it is worthy only of so much consideration as may tend to show its defects and disabilities.

County government in most states is in almost as bad condition as it is in New York, and this discussion may apply almost equally well to any other state.

FINANCING ROAD BUILDING.

Modern road construction has proceeded far enough to begin to show the difficulties which may arise in financing maintenance, which, added to the financing of new construction, may call a halt upon construction in some States. MUNICIPAL ENGINEERING has advocated, during all of the campaigns for new roads built by modern methods, that the character of road should be suited to the traffic to which it is to be subjected. This is economy both in construction and in maintenance, and a State which adheres to this conservative policy will make more uniform progress than one which goes wholesale into the construction of high-class roads without previous consideration of the resulting annual expenditures for interest on bonds, for retirement of bonds and for maintenance and repair of the new roads. Such States as Indiana, Ohio and Kentucky have now many miles of mcadam and gravel roads, which are fully equal to the duties required of them, but they need proper maintenance to make them wholly efficient.

Mr. Gibbon's article on another page gives a clear statement of the difficulties in Indiana. The money for these repairs is now available if there were a proper system of expert supervision of the maintenance of roads, so that this problem is not one of new financing, but of improving the present method of expending the available money and converting the labor available into its cash equivalent.

There are, however, a good many miles of these roads in the statement of mileage, which are not equal to the duties required of them, and they should be eliminated from the tables for the reasons given by Mr. Gibbon. He also shows the difficulty of taking care of these roads under the present Indiana laws. Other States have similar difficulties, if not exactly the same. Here some expert financial help is needed. The main roads, as so clearly shown by Mr. Gibbon, are worn out by through traffic, much of which is automobile, because the original construction was not sufficient and because the appropriations for repair have not been adequate, until now the roads are worn out beyond hope of repair and must be reconstructed.

It is claimed by some that this repair should be paid for by those who have made it necessary, viz., the automobilists, or that the reconstruction should be paid for by them. In considerable degree this is true, but the rapid wear is due not alone to the automobile, nor to the horse-drawn traffic, but to the combination of the two. Repair for either one alone would be comparatively easy and inexpensive. It is the combination which makes the problem so serious.

Early in the history of automobiling it might have been said, and was, that the automobilists developed the new difficulties, and they were in a special class which it might have been proper to treat in a specially drastic manner, but now the use of the automobile is so general, by denizens of the country as well as of the city; the increase in their use for hauling crops and materials to and from the farm, as well as between towns, is so directly dependent upon the excellence of the roads that it is no longer possible to place the automobilists in a class by themselves.

Students of the problem are rapidly coming to a state of mind which calls for the construction of these main roads as a general charge upon state, county and township, with assessment of some portion thereof upon the property locally and directly benefited in proportion to such benefit. They are also coming to believe that the traffic over the road should pay for the maintenance of the road after it is constructed.

The difficulties and expense connected with the maintenance of toll gates are such that the next alternative, that of graduated vehicle taxes, is usually chosen. The Governor of Massachusetts and the chairman of the State Highway Commission have recommended an annual tax on automobiles of $1 per horsepower, on the argument that wear of roads is roughly proportional thereto, either on account of speed or on account of weight of loads on commercial vehicles. One of the bills presented to the Indiana Legislature last year went still further, and most properly, and extended the vehicle tax to include all vehicles using or likely to use the roads. Granted the principle, the application thereof is a matter of development. None of us know as yet the proportional wear of roads by horses, horse-drawn vehicles, narrow or wide tires, steel or rubber tires, automobiles of high speed, of heavy weight, alone or used as locomotives for wagons or cars behind, etc., and this question must be thoroughly studied before a thoroughly equitable vehicle tax law can be framed. Meanwhile the financial problem is pressing and we must put some plan in operation which will bring in the money, and must correct as they appear the injustices which will arise from any law framed in our present state of ignorance.

The financial problems will apparently be most easily solved if, therefore, we bear in mind—

1. That the character and quality of road building should suit the traffic expected over them, thus reducing cost of some roads, postponing indefinitely the reconstruction of some and materially increasing the cost of some.

2. That the cost of the new roads should be distributed over state, county, township and abutting property in equitable proportions, thus increasing, probably, the expenditures of no one of these classes except the State, but securing better results.

3. That the present available funds for road construction can be administered more efficiently and economically and that they should be supplemented by equitable assessment upon the direct users of the roads of a portion of the cost of maintaining them as nearly as possible in proportion to their wear of the roads or the possibility thereof.

Roads wear out rapidly, and even if they are maintained efficiently they must be reconstructed at intervals. Bonds issued to pay for roads, like every other bond for the construction of a public utility, should have terms not longer than the estimated life of the road built with their proceeds.

THE QUESTION DEPARTMENT

Legal Practice in Street Improvements in Illinois.

I am city attorney of this Illinois city, which contains a population of about three thousand. The city authorities propose to pave about one mile of the streets of this city, and with that end in view have directed me to prepare the necessary resolutions and recommendations of the board of local improvements, and also the proper ordinances or ordinance therefor.

I enclose you a plat of the proposed paving. This plat is not, however, drawn to a scale. Beginning at the east or right side thereof, the paving will run two blocks west at a proposed width of 24 feet, thence one block south at a proposed width of 30 feet, thence one block west at a proposed width of 24 feet, thence south one block, proposed width 24 feet; thence west two blocks, proposed width 24 feet; thence south four blocks at a proposed width of 36 feet, thence continuing south one block at a proposed width of 30 feet, thence continuing south five blocks at a proposed width of 27 feet, thence around the public square, the proposed paving on the north and south sides thereof to be 36 feet in width, and on the west side thereof to be 30 feet in width.

You will notice that the line of paving will be continuous and contiguous. All of the same is to be of the same material and of the same method of construction. It is proposed that the whole cost of the paving be assessed against the property owners, to be collected by special taxation.

I am undecided on the following propositions: First, as to whether or not the whole cost of this paving can be assessed and collected from the property owners, meaning in this regard whether or not the property owners can be made to pay for paving the intersections of the streets. Second, whether or not this can be considered as one improvement and all embraced in one ordinance and one assessment roll.

The puzzling part of this proposition is whether or not the different widths upon the different streets and upon parts of the same streets as heretofore indicated and as shown on the plat, will make any difference as to whether or not the same can be considered as one improvement.

I wish you would give me some information in this matter and answer the foregoing propositions. The reasons for the different widths briefly are about as follows: The 24-foot line is upon narrower streets and away from the business section of the city; the one block of 30-foot pavement indicated in the 24-foot line is upon an unusually wide street, and this is widened for appearances principally; the 36-foot pavement is upon wide streets in the business portion of the city; the 30-foot pavement on the west side of the square is on account of a narrow street, the street being too narrow for a 36-foot pavement; the 30-foot pavement on Main street, and from thence on the 27-foot pavement, is in the residence portion of the city, and it was considered this width would be sufficient, notwithstanding the street continues the same width; the one block of 30-foot pavement between the 27-foot and the 36-foot was deemed proper so as not to make too sudden a change in width, principally for appearances.

M. T. R., City Attorney, ———, Ill.

The local improvement laws of Illinois are so general and indefinite in their nature that the practice and the court decisions have not been uniform. About four years ago the National Paving Brick Manufacturers' Association made an effort to increase the uniformity in practice and prepared a set of forms for use in all the steps to be taken in making local improvements from the petition for the improvement to the warrant of the collector of delinquent assessments. This book can probably be obtained from the secretary of the association in Cleveland, Ohio, and should be of much assistance in such cases as that described above.

There seems to be nothing in the law or in these forms to prevent including all the streets described in the question in one proceeding, provided the form of procedure is selected which assesses the cost according to benefits and not according to frontage. The cost of intersections can be assessed upon the city or upon the property, as may be decided in framing the ordinance. If bids are received per square yard of paving, per linear foot of curb, etc., it will be a little easier to determine the cost of each particular street or portion of street than if the contract is let for a lump sum, but in either case the assessment board can determine without much trouble the proportionate benefit to all the property affected.

Whether there are any court decisions which would modify this interpretation of the statutes is not known to the writer.

Ordinances for Removal of Obstructions From Streets.

I am now at work on an ordinance to remove wires, poles, signs, etc., out of business street. What data have you on such ordinance.

W. B. J., City Solicitor, ———, O.

These ordinances vary in the form as well as in the nature of their provisions, according to the constitutional and statutory provisions in the various States. The following are provisions in the ordinances in Ohio cities which are probably applicable to the city in question, although it is much smaller than either of them:

Cleveland covers the question of signs in a section which reads as follows: "All sign-

boards and billboards now or hereafter erected on any residence street within 200 feet of any park, park boulevard or driveway, except signboards not exceeding a one-sheet board in area, used for advertising the sale or renting of the property on which they are located, and all signs on buildings on any residence street within said 200 feet, except signs advertising the business within, or signs used to advertise the selling or renting of the property, are hereby declared to be public nuisances, and any such first described signboards or billboards now existing shall be removed by the owners thereof within 30 days after the passage of this ordinance, and upon failure thereof the same shall be torn down under the direction of the inspector of buildings." The building code gives full specifications for all kinds of signs and provides that "any existing sign now erected on the outer wall of any building or attached to a projection thereto, and in conflict with the provisions of this code, shall be removed when rotten or unsafe or when ordered to be removed by the inspector of buildings. There is a similar specification for poles and posts on public property and requiring permits from the Board of Public Service for their erection, and also providing that "no posts, poles or signs heretofore erected or placed in or upon any sidewalk or street or other public places within the city limits shall be permitted to remain, except as provided in this section."

To remove wires entirely from a portion of the city streets is a more difficult problem, as it requires provision for conduits to carry the wires. The ordinances for placing wires underground in certain named streets in Cleveland are good models, though perhaps a little more complicated than would be necessary in a small city.

The Dayton ordinance regarding removal of signs is very simple. It is a section of the ordinance prescribing the methods of regulating signs, and says: "Any sign which extends over any part of any public way shall be removed by the owner or owners or user or users thereof upon 30 days' notice from the Board of Public Service so to do, and upon failure so to remove same, it may be removed by said board."

Poles, wires and conduits are regulated in Dayton by the ordinances granting privileges to the various companies requiring them in their operations.

Mileage of Pavements in United States.

Can you furnish us the following information, or inform us where we can get it without writing to the separate cities?

Miles of pavement in the different cities in the United States of 25,000 population and over. O. L. E., Oklahoma City, Okla.

This information is given for cities of over 30,000 population in the periodical volume of "Statistics of Cities Having a Population of Over 30,000," the latest printed edition of which is for the year 1908 and was printed in 1910.

Street Areas in Large Cities.

We are anxious to obtain statistics either accurate or estimated as to the proportionate street areas as compared with the building areas in the business sections of the following cities, New York, Chicago, Boston, Philadelphia, London, Paris, Berlin, Brussels, and Rome.

If you can supply us with any portion of this information or can refer us to any other authority the courtesy will be highly appreciated.

H. C. B., New York City.

The usual proportion of street area to total area of city is stated to vary in cities of the United States from 20 to 40 per cent. with Washington an exception, having 54 per cent. of street area. The report on social statistics of cities in the United States at the census of 1890 gives some figures from which the following percentages of areas not available for buildings may be computed. There is but little detail of information given, but it may be assumed that this area not available for building includes streets, parks, public places, alleys, water and other public space. New York had 37.6 per cent of such open space, Berlin 66.1; Boston 17.1; Brussels 58.0. Elsewhere in the same report is a statement of lengths of streets and alleys and average width of streets. The mileage of alleys being small in the eastern cities it will not be a serious error to assume the average width of streets to be the average width of streets and alleys, and, with this assumption, New York is found to have 16.2 per cent of its area in streets, Chicago 16.0 per cent, Boston 8.2 per cent and Philadelphia 8.4 per cent. Again in the report of the U. S. Census Bureau for 1907 on statistics of cities the lengths of streets are given and widths of pavements. These widths check the assumed total widths of streets from the earlier census report and, using them, it is found that New York has 10.9 per cent of its land area in streets, Chicago has 30 per cent, Boston 9.4 per cent and Philadelphia 12.9 per cent. These areas do not include alleys. The large increase in Chicago seems to be due to a much larger increase in length of streets than in area between 1890 and 1907, even though the figures for the latter year do not include alleys, of which Chicago has many miles.

Garbage Disposal for Small City.

This is a city of the sixth class, a health resort, with population of 2,000. The garbage question has become very acute. Can you let me know:

First. The cost of an incinerator to dispose of four tons of garbage per day? We would not wish to utilize the residue.

Second. The cost of operating the same.

Third. The best method of disposing of garbage for a city of this size situated upon a level peninsula, without facilities for taking the same to sea.

PRESIDENT BOARD OF TRUSTEES,
———, Cal.

There are so many differences in local

conditions that definite answers to these questions cannot be given for any one locality without study of them upon the ground. Some general information can be given, however.

Small garbage destruction plants are manufactured by the following firms, concerning which, as well as others, reference may be made to the "Business Directory" published in each number of MUNICIPAL ENGINEERING, under the headings "Destructors," "Garbage Disposal Plants," "Incinerators," "Refuse Destructors," Buffalo Engine Company, Buffalo, N. Y.; City Wastes Disposal Company, 156 Fifth avenue, New York; The Destructor Company, 111 Broadway, New York; J. B. Harris, 210 Stahlman building, Nashville, Tenn.; Specialty Engineering Company, Houston, Tex.; J. G. Branch, St. Louis, Mo.; Griscom-Spencer Company, 90 West street, New York City; Morse-Boulger Company, 39 Cortlandt street, New York City.

Some of these plants have as small capacity as 50 or 60 pounds per hour. It would probably be best for a small city, especially if it has a fluctuating seasonal population as a health resort, to install a plant of larger size than would be actually necessary and then run the plant as many hours a day or as many days a week as might be found necessary according to the season. This is done with government plants at army posts, quarantine stations, etc., common capacities per 24 hours being 5, 8 and 12 tons, the maximum capacity being reached only under conditions of very exceptional crowding of accommodations. A few cities have plants of about the sizes named, such as Coalinga, Cal.; Oak Park, Ill.; Butte, Mont.; Easton, Pa.; Santa Clara, Cal.

The cost of the plants varies greatly. The reported costs of the government plants are possibly greater than would be the case for small city plants. Thus one three-ton plant ready for erection in building cost $700, and a five-ton plant, $1,059. Another three-ton plant, erected but not including building, cost $2,400, and five-ton plants, erected but not including building, cost from $1,200 to $3,985. Five-ton plants, with building, complete, cost from $2,740 to $4,000. Much of the variation in cost is due to location and differences in cost of labor, materials and freight. Small city plants of 10 to 20 tons capacity per 24 hours have cost $1,900 to $4,295, erected, without a building, and others have cost $3,000 to $4,650, including building.

Several garbage furnace builders can supply portable furnaces large enough for the duty specified, such as the Destructor Company, 111 Broadway, New York; Isaac D. Smead, 141 East Fourth street, Cincinnati, Ohio; possibly the Decarie Manufacturing Company, Minneapolis, Minn., and Griscom-Spencer Company, 90 West street, New York.

Much of the above information about cost of plants is taken from Morse's "The Collection and Disposal of Municipal Waste" ($5), which is a compendium of valuable information on all branches of the subject.

The cost of operating the plant is even more indefinite than the cost of the plant. If the collectors can take care of the burning as well as the collection of refuse, and all the combustible refuse as well as well-drained garbage is collected, it may be possible to burn it with no fuel aside from the combustible refuse collected, in which case there would be no additional cost for disposal beyond the repairs, interest and depreciation on the plant. But if the garbage alone is collected and it is very wet, and a ton of coal at $5, say, may be required for four tons of garbage, and one or two extra men are required to take care of the furnace, the cost might easily run to $1.50 or $2 per ton of garbage destroyed. The true state of affairs would lie between these limits, and that is about all that can be said except by one who devises a plan and is given authority to carry it out.

Perhaps more information can be gathered from MUNICIPAL ENGINEERING than from any other single source. In a succeeding article on "Information Concerning Garbage Collection and Disposal" will be found a list of articles in the later volumes of MUNICIPAL ENGINEERING on the subject. Other lists of articles in still earlier volumes are referred to therein.

A few notes may be given here concerning small plants not referred to in the articles in the list.

C. E. Moore, city engineer at Santa Clara, Cal., reports that he built a small plant for $900, including a small building over the front and a shed roof over the receiving platform. He reported about 75 cubic yards of garbage destroyed per month, with slab fuel, at a cost of $20 for attendance and $8 for fuel, or about 35 cents a cubic yard, possibly equivalent to 70 cents to $1 per ton. The operation is not continuous and probably three times as much garbage could be disposed of for very nearly the same total cost.

The garbage furnace at the Naval Training Station, Newport, R. I., cost $8,599 complete and will destroy 2,032 pounds of garbage per hour. Its regular operation is 8 hours a day and it uses 1 pound of coal to burn 16.1 pounds of garbage. Attendants cost $2 a day and coal costs $3.60 a ton. An average for several months showed 4.5 tons of garbage burned per day at a cost of 65 cents per ton.

The plant at Oak Park, Ill., having a capacity of 30 tons a day, burns 9 to 10 tons, with a consumption of 1,400 to 1,600 pounds of coal. The fuel charge is about 20 cents per ton at this low rate of operation and the labor charge perhaps 30 cents more.

List of Articles on Garbage and Refuse Collection and Disposal.

I note that from time to time you have published lists of references on various engineering subjects found in past numbers of your valuable magazine. These lists I have found very valuable, but it has occurred to me that it would be still more valuable if you could publish a list of such lists, i. e., list of pages and general subjects only, going back, say, not longer than five or six years. I am sure that many of your readers would find such a general list, referring them to volume and page where they could find such information, of great value to themselves. L. S. S., ———, Wis.

In response to the above suggestion and in further reply to a question from another correspondent, the following classified list of articles in recent volumes of MUNICIPAL ENGINEERING on garbage collection and disposal has been prepared. Lists on other subjects will be prepared on request, and a list of these lists will be printed occasionally.

The general principles to be followed in devising a system for collecting and disposing of municipal refuse are well stated in such articles as that on "Refuse Disposal in Cambridge, Mass., xlii, 101; "The Pittsburgh Garbage Problem," xli, 61; "Reduction of Garbage," xl, 36; "Garbage and Refuse Collection and Disposal," xl, 106; the series of articles on "Town Scavenging and Refuse Disposal," xxxvii, 287; xxxviii, 1, 73, 143, 229, 299, 381; xxxix, 1, 85; "City Refuse Collection," xxxix, 286; "Night Soil Removal," xxxviii, 37; "Boston Report on Collection and Disposal of Refuse," xxxviii, 209; "High Temperature Garbage and Refuse Destructors," xxxviii, 258; "Disposal of Municipal Refuse in the United States," xxxv, 377; "Refuse Destruction for the Borough of Richmond, New York City," xxxii, 39; "Garbage Incineration for St. Louis," xxx, 28; "Garbage Collection and Disposal in St. Louis," xxx, 214; "Sewage and Dye Waste Disposal," xxx, 276.

Various systems and plants for collecting and disposing of garbage and refuse are described more or less fully in: "Harris Combination Incinerator and Power Plant," xlii, p. 205: "A Municipal Garbage Incinerator and Steam Generator," xli, p. 405: "The Garbage Crematory at Houston, Texas," xl, 177; "The Municipal Garbage Reduction Plant at Columbus, Ohio," xl, 322; "Special Services to Rochester Citizens," xxxix, 24; "The Municipal Garbage Reduction Plant at Columbus, Ohio," xxxix, 135; "Specifications for New Incinerating Plants for San Francisco," xxxix, 226; "Garbage Collection and Disposal in Minneapolis, Minn.," xxxix, 275; "Garbage Cremation," xxxviii, 63; "Garbage Collection and Disposal Plans for New Orleans," xxxvii, 49; "A Combined Refuse Destructor and Generating Plant," xxxvi, 253; "Refuse Destruction in Richmond Borough, New York City," xxxv, 359; "English, German and Swiss Destructor Plants," xxxii, 371; "Westmount, Quebec, Garbage Destructor," xxxi, 50; "Disposal of Dye and Wool Finishing Waste," xxxi, 204; "Garbage Disposal by Reduction Methods," xxxi, 211; "Street Cleaning and Disposition of Sweepings," xxxi, 374; "Garbage Reduction," xxxi, 414; "Garbage Disposal in Detroit," xxxi, 436; "Test of the New Decarie Garbage Incinerator at Duluth," xxx, 235, 313.

Articles giving some figures of cost of construction and operation of plants and of collection include: "Bids for Garbage Plant at Paterson, N. J.," xli, 483; "The Milwaukee Refuse Incinerator," xli, 148; "Sewage nd Refuse Disposal in Memphis, Tenn.," xxxix, 4; "Garbage Disposal in Paris," xxxix, 224; "Refuse Disposal in Somerville, Mass.," xxxix, 319; "Sanitary Railroad Construction Camps on Cedar River Watershed, Seattle, Wash.," xxxvi, 146; "Garbage and Refuse as Fuel in Nottingham, England," xxxv, 394.

Statistical data on garbage collection and disposal will be found in "Garbage Collection and Disposal," xl, 281; "Garbage Disposal and Street Cleaning Details," xxx, 25.

Sanitary garbage carts are described in "German Garbage Carts," xlii, p. 106; "Refuse Disposal in Berlin, Germany," xli, 476; "Odorless Garbage and Refuse Carts," xxxvii, 129; "A Steel Sanitary Cart," xxxvi, 195.

Feeding of garbage to hogs is described in an article on "Garbage Disposal in Montclair, N. J.," xli, 147.

Regulations and ordinances governing garbage and refuse collection and disposal are given in "Regulations for Collecting Garbage at Householders' Expense," xl, 348; "Suggested Garbage Receptacle Ordinance for St. Louis," xl, 445; "Refuse Can Be Dumped in Lake Michigan Only Behind Breakwaters," xxxix, 55; "Garbage Ordinance," xxx, 34.

Legal decisions and opinions on phases of garbage and refuse disposal nuisances, contracts, etc., will be found in "Exclusive Privilege of Collecting Garbage," vol. xl, p. 137; "Maintenance of Noxious Garbage Dump by City and Liability for Nuisance," vol. xxxviii, p. 352; "Ohio Cities Can Not Restrict Garbage Collection," vol. xxxi, p. 120; Exclusive Garbage Contracts Can be Made, xxx, 28.

Reviews of Books on the subject: Morse's "The Collection and Disposal of Municipal Waste," vol. xl, p. 143; Parsons's "Disposal of Municipal Refuse," vol. xxxv, p. 48; Baker's "Notes on British Refuse Destruction," vol. xxxv, p. 325; Venable's "Garbage Crematories in America," vol. xxxiv, p. 44; Branch's "Heat and Light from Municipal and Other Waste," vol. xxxiv, p. 111.

Descriptive lists of articles, most of which are also included in this list, will be found in "Disposal of Sewage and Refuse," vol. xli, p. 289; "Information About Garbage Collection and Disposal," vol. xli, p. 291; "Information About Garbage Destruction," vol. xxxix, p. 39; "Garbage Collection in Small City," vol. xxxviii, p. 194; "Garbage

Disposal in America," vol. xxxviii, p. 422; "Collection and Disposal of Garbage in Small Cities," vol. xxxvii, p. 36; "Information on Refuse and Garbage Disposal," vol. xxxvi, p. 257; "Information on Street Cleaning and Garbage Collection and Disposal," vol. xxxv, p. 179; "Garbage Disposal," vol. xxxii, p. 95; "Disposal of Garbage in Small Towns," vol. xxxi, p. 454; "Power from Garbage Destructor," vol. xxx, p. 25.

Miscellaneous articles of less importance include: "To Exhibit Cleveland's Garbage Plant," vol. xli, p. 147; "Los Angeles' Refuse Disposal," vol. xli, p. 480; "Baltimore Collects Its Own Garbage and Refuse," vol. xl, p. 127; "Modern Municipal Sanitation in Cuba," vol. xl, p. 333; "Information About Garbage Plants," vol. xl, p. 350; "Cities Operating Garbage Incinerators," vol. xl, p. 427; "Manufacturers of Garbage Disposal Plants," vol. xl, p. 428; "Test of Decarie Garbage and Refuse Incinerator," vol. xl, p. 460; "Los Angeles Has a Garbage Nuisance," vol. xxxix, p. 54; "Garbage Reduction," vol. xxxix, p. 153; "Municipal Improvements in Richmond, Ind.," vol. xxxix, p. 194; "The Destructor Company," vol. xxxix, p. 415; "Municipalities Operating Garbage Reduction Plants," vol. xxxix, p. 471; "Garbage Disposal for Small City," vol. xxxviii, p. 267; "Municipal Garbage Collection Proposed for Washington, D. C.," vol. xxxviii, p. 431; "Garbage Disposal and Street Cleaning," vol. xxxiii, p. 236; "Pollution of Sea Beaches in New Jersey Must Stop," vol. xxxiii, p. 263; "Garbage for Fuel," vol. xxxii, p. 314; "Ashes Removed by Trolley Cars," vol. xxxii, p. 335; "Cost of Street Cleaning, Garbage and Light in Cleveland," vol. xxxi, p. 189; "Garbage and Refuse Disposal in Pittsburg," vol. xxxi, p. 210; "Hogs Proposed as Garbage Disposal Plant for Boston," vol. xxxi, p. 210; "New York Garbage on New Jersey Beaches," vol. xxxi, p. 211; "What Is the Best Method of Garbage Disposal?" vol. xxxi, p. 280; "Odorless Excavators," vol. xxxi, p. 280; "Detroit's Garbage Question Undecided," vol. xxx, p. 292; "Chicago's Garbage Problem Postponed," vol. xxx, p. 292.

The correlative subject of abattoir management is treated in "A European Abattoir," vol. xl, p. 490; "Municipal Abattoir," vol. xxxix, p. 33; "The Municipal Abattoir and Reduction Plant at Paris, Texas," vol. xxxix, p. 90; "Austin Contemplates a Municipal Abattoir," vol. xxxix, p. 479; "A Municipal Abattoir in South Africa," vol. xxxv, p. 224; "Municipal Slaughter Houses," vol. xxxiv, p. 237; "Purification of Slaughter House Refuse at Zerbst, Germany," vol. xxxi, p. 86.

Crematories for Human Bodies are named in vol. xxx, p. 199.

Records in a City Engineer's Office.

I would like to get the most modern method of keeping city records for a city enginer's office, giving the method in detail, such as water mains and service connection to same, sewers and their connections and all records that should be kept by a city engineer. Are there any books published that give the information?

U. M. E., City Engineer, ————, Minn.

There is no book which is of direct application to the problem stated. The books on accounting, recording and filing give principles which are applicable, and also many details of method, but laws, customs and other local conditions vary so much that no book could cover them all. The following articles in MUNICIPAL ENGINEERING treat the subject from almost every viewpoint and will be of much assistance in working out a system. Some of them refer to other articles in still earlier numbers, as well as to books and other sources of information.

"Record of Water Fixtures and Meter Readings," vol. xlii, p. 121.

"Method of Keeping Record of Improvements to Established Water Works Plants," vol. xli, p. 13.

"Books on Accounting for Contractors," vol. xli, p. 129.

Review of Gillette and Dana's "Cost Keeping and Management Engineering," vol. xl, p. 446.

"Contracting Practice," vol. xl, pp. 393, 475; vol. xli, pp. 1, 93, 173, 252, 337, 421; vol. xlii, pp. 23, 104, 149.

"A Card Index of Catalogs," vol. xl, p. 536.

"Form of Grade Book for Small City," vol. xl, p. 210.

"Smoke Abatement Campaign Material," vol. xl, p. 354.

"Record of City Improvements," vol. xl, p. 222.

"Forms for Proposals and Estimates," vol. xl, p. 344.

"Water Rates and Records at Valparaiso, Ind.," vol. xxxix, p. 18.

"Forms of Receipts and Water Bills and Water Rates," vol. xxxix, p. 120; vol. xxxviii, pp. 184, 347, 423.

"The Card Index Applied to Fire Fighting," vol. xxxix, p. 130.

"The Classification and Filing of Technical Memoranda," vol. xxxix, p. 190.

"Card Index for Engineer's Office," vol. xxxviii, p. 113.

"Bookkeeping for Metered Water System," vol. xxxviii, p. 182.

Review of the annual report of the city engineer of Salt Lake City, Utah, for 1908, which gives detail as to classification and methods of keeping records and accounts by a system which is very complete and is doubtless efficient; vol. xxxviii, p. 56.

"Handling Day Labor in Holyoke, Mass.," vol. xxxviii, p. 202.

"Improved Municipal Accounting for Washington," vol. xxxviii, p. 208.

"Forms for Daily Force and Material Reports," vol. xxxviii, p. 270.

"Service Reports and Balance Sheets for City Law Departments," vol. xxxviii, p. 348.

"Model Form of Report for Water Works Department," vol. xxxviii, p. 350.

Review of Garrison's "Accounting Every Business Man Should Know," vol. xxxviii, p. 357.

"Forms of Meter Repair Records," vol. xxvii, p. 260.

"Control of Workmanship on Asphalt Pavements," vol. xxxvii, p. 301.

"Cost Keeping on Municipal Contract Work," vol. xxxvi, p. 1.

"A House Numbering System," vol. xxxvi, p. 38.

"A System in Municipal Accounting, vol. xxxv, p. 22.

"Water Rates and Rentals," vol. xxxv, p. 73.

"System of Accounts for Small City," vol. xxxv, pp. 177, 246.

"Municipal Accounting System of Atlantic City, N. J.," vol. xxxv, p. 298.
"The Ohio Law on Supervision of Accounts of Public Officials," vol. xxxiv, p. 90.
"State Supervision of Public Accounts Recommended for South Carolina," vol. xxxiv, p. 104.
"Books for Keeping Water and Light Plant Accounts," vol. xxxiv, p. 165.
"Books on Operation of Water and Light Plants," vol. xxxiv, p. 231.
"A Daily Report Form for Street Work," vol. xxxiv, p. 239.
"New Accounting System for Springfield, Ill.," vol. xxxiv, p. 245.
"A Few Experiences in the Examination of Water Works Accounts and Management," vol. xxxiii, p. 40.
"The Demand for Better Forms of Municipal Accounts and Reports," vol. xxxiii, p. 42.
"City Engineer's Office Records," giving references to a number of earlier articles on this subject, vol. xxxii, p. 18.
"Form of Pumping Station Records and Sinking Wells," vol. xxxii, p. 21.
"Establishing Street Grades and Water for Concrete," referring to a number of articles on procedure and records, vol. xxxii, p. 22.
Review of McCullough's "Engineering Work in Towns and Small Cities," vol. xxxii, p. 49.
Review of Mulhall's "Quasi-Public Corporation Accounting and Management," vol. xxxii, p. 188.
Review of Gillette's "Handbook of Cost Data for Contractors and Engineers," vol. xxxii, p. 189.
"A Method of Filing Notes, Sketches and Clippings," vol. xxxi, p. 41.
"Filing and Indexing City Engineers' Records," vol. xxx, p. 270.
"Loose Leaf System for Field Notes and Office Records," vol. xxx, p. 409.

Cost of Electric Current in Cities.

Our city is investigating the cost of electric current for lighting, heat and power purposes.

I presume you have this information easily accessible, as the question often arises. Therefore for the city and myself I request such information as you can furnish on the following questions:

In cities between 100,000 and 200,000 population in the United States—

1. What is the cost per arc light per annum?
2. What is the cost per incandescent lamp per annum?
3. What is the price to consumers for such electric current? The classes into which consumers are divided, and the price charged each?
4. The cost of production and transmission of such current in these cities?

J. L. MAYSON, City Attorney, Atlanta, Ga.

1. The cost per arc light per annum for street lighting is as follows, all-night schedule:

Columbus, O.—Municipal plant.
Toledo, O.—2,000-c. p. magnetite arcs, $83.
Atlanta, Ga.—500-w. arcs, $60.
Oakland, Cal.—2,000-c. p. arcs, $75.60.
Worcester, Mass.—380-w. arcs, $91.25.
Syracuse, N. Y.—2,000-c. p. arcs, $68.
New Haven, Conn.—320-w. arcs, 20 cents per night, or about $73 a year.
Birmingham, Ala.—450-w. arcs, $70 a year. City also has small plant.
Memphis, Tenn.—1.5-amp. arcs, $75.
Scranton, Pa.—A. c. and d. c. arcs, 480-k. w., $72.
Richmond, Va.—Arcs, $54.75 and $57. Also has municipal plant, now using water power.
Paterson, N. J.—2,000-c. p. arcs, $77.50.
Omaha, Neb.—A. c. arcs, 6.6-amp., $60.
Fall River, Mass.—4-amp. magnetite arcs, $91.25.
Dayton, O.—465-w., d. c., series arcs, $66.
Grand Rapids, Mich.—Municipal plant, costing city, for 2,000-c. p. arcs, $57.24 a year.
Nashville, Tenn.—Municipal plant.
Lowell, Mass.—4,000-c. p. arcs, $100.
Cambridge, Mass.—450-w. arcs, $90.
Spokane, Wash.—7.5-amp., 2,000-c. p., series arcs, $58.
Bridgeport, Conn.—1,200-c. p. magnetite arcs, $73.
Albany, N. Y.—2,000-c. p. arcs, $98.55.

2. The cost per incandescent lamp per year for street lighting, all-night schedule, is as follows:

Atlanta, Ga.—75-c. p., $33.75.
Oakland, Cal.—16-c. p., $7.20.
Worcester, Mass.—50-w., tungsten, $18.
Syracuse, N. Y.—128-w. and 50-w., $24 to $20.
New Haven, Conn.—8 to 100-c. p., 11 cents per k. w.
Scranton, Pa.—40-w., series tungstens, $15.
Paterson, N. J.—$15 to 20.
Omaha, Neb.—50-w. tungstens, $15.80.
Fall River, Mass.—40 and 75-w. tungstens, $20 and $25.
Dayton, O.—60-c. p., 6.6-amp. tungstens, $24.
Lowell, Mass.—25 and 40-c. p., $18 and $22.50.
Cambridge, Mass.—40-c. p. tungstens, $25.
Spokane, Wash.—100-w. tungstens, $18.
Bridgeport, Conn.—75-w., series arc, $27.
Albany, N. Y.—40-c. p. Mazda, $20.

3. But few prices to consumers are at hand. They are as follows:

Toledo, O.—9 cents per kw. hr., 10 per cent discount.
Oakland City, Cal.—10 cents per kw. hr., 5 to 65 per cent discount for light; 5 to 12 cents per kw. hr. for power.
Syracuse, N. Y.—8 cents per kw. hr., 10 to 40 per cent discount for light; 8 to 1.75 cents for power.
Birmingham, Ala.—12 cents per kw. hr. for light and 7 cents for power, with discounts.
Memphis, Tenn.—11 cents per kw. hr., 1 cent discount for light; 10 cents, with discounts, for power.
Paterson, N. J.—10 cents per kw. hr., with discounts for quantity, for light, and for quantity and demand for power.
Nashville, Tenn.—For commercial incandescents and 500 to 2,000-c. p. arcs, 12 cents per kw. hr. is charged by private company furnishing them.
Lowell, Mass.—Commercial arcs and 16-c. p. incandescents cost 11 cents per kw. hr.

4. The cost of production and transmission is not available. One item of importance is the cost of coal, which is reported as follows, per ton:

Columbus, O., $1.29.
Toledo, O., $1.50 to $1.65.
Atlanta, Ga., $2.
Oakland, Cal., oil, 2.3 cents per gallon.
Worcester, Mass., $4.40.
New Haven, Conn., $4.
Birmingham, Ala., $1.55 at city plant, $1.50 at private plant, delivered.
Memphis, Tenn., $1.45 to $1.65.
Scranton, Pa., $1.25.
Richmond, Va., $3 to $2.63.
Omaha, Neb., $2.40.
Fall River, Mass., $3.40.
Dayton, O., $2.25 to $2.18.
Grand Rapids, Mich., $2.94.
Nashville, Tenn., $2.80.
Lowell, Mass., $5 to $4.53.
Cambridge, Mass., $4.
Spokane, Wash., water power.
Bridgeport, Conn., $3.85.
Albany, N. Y., slack, $3.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited.
Give from your experience for the benefit of others.
Never mind style of composition, the fact is what is wanted.

Thorough Study of Smoke Problem in Progress.

To the Editor of MUNICIPAL ENGINEERING:

Sir—It may be of interest for you to know that we are entering upon a study of the smoke problem in the broadest possible manner.

We are taking the following as our chief lines of investigation: The effect of smoke on health, plant life and buildings. We are also considering the increased cost of living due to damage and dirt caused by smoke, and the legal as well as the engineering side of the question. Each of these investigations will be carried out by one or more men, each a specialist in his line.

It is hoped that by co-ordinating these various researches it will be possible to obtain some valuable technical as well as scientific data. We will at least be able to establish the status of the problem, as a whole, on a scientific basis.

I am writing at this time to see if you will not aid us in this undertaking by making mention of the work we are doing in the pages of MUNICIPAI ENGINEERING. We should like to get in touch with people interterested for the purpose of co-operation, information and suggestions.

Thanking you in advance for any aid that you may see fit to render us, I beg to remain,

Very truly yours,

R. C. BENNER,

Department of Industrial Research, University of Pittsburg, Pa.

Water Tight Sewer Joints.

To the Editor of MUNICIPAL ENGINEERING:

Sir—Seeing the mention of "Jointite" in your February issue I thought perhaps you might be interested in knowing may experience with same on sewer work at Summit, of which place I am city engineer, so I am enclosing an outline of its use and a few details of cost and my reasons for making water-tight joints which I thought might be on interest to some of your readers.

JOHN S. STIGER,

City Engineer, Summit, N. J.

Experiments were made by the writer during the winter of 1909-10 on waterproofing sewers. These experiments resulted in getting a flexible water-tight joint material that would remain water-tight under pressure when deflected to a very great degree. This property is of great value not only in lessening the liability to injury of the joint when constructing the sewer but later when settlement is so apt to occur. This material, known as Jointite, manufactured by the Marbleoid Co. of New York City, is heated to a temperature of 400 degrees or more and poured into joints in similar manner to lead and can be safely handled in all kinds of weather without danger of cracking tile or of poor results.

One of the peculiarities of the material, which is of great value, is that it adheres to a wet pipe, apparently dispelling moisture in the form of vapor produced by the heat of the mixture. I have often in my work at Summit poured joints in from 4 to 6 ins. of water with apparently the same good results as if poured on dry pipe. Lines so run stood both an outside and inside water test. However, I do not of course advise pouring joints in water where it is practical to pump, which is usually the case, and in fact almost always necessary in order to handle the excavation economically. On 8 in. deep and wide socket tile pipe I specify 3 lbs. of compound to a joint and as the cost of the material is $105 per ton or 5½ centts per poundd it would make the cost of these water-tight joints, including labor of running, about 7 cents per foot, or slightly less than $370 per mile. Engineers differ as to the cost of cement joints but I think all will agree with me that $100 per mile would be a very low estimate. This makes the additional cost of $270 per mile for sewers that will remain water-tight under all conditions, as I have proven during the past two years on over twelve miles of sewers laid throughout the city of Summit.

As half the sewerage in Summit has to be pumped, I estimate that the saving in cost of pumping alone would pay the additional cost of water-tight joints in less than five years. Based on the average infiltration of 140 miles of sewers throughout the small towns in Massachusets as reported by Mr. Kenneth Allen, of 40,000 gals. per mile daily, the cost of pumping this infiltration would amount to as much in one year and two months as the additional cost of making tight joints. Summit's infiltration is much less than most towns owing to the hilly or rolling surface and porous sub-soil, therefore it would be less important to make water-tight sewers here than in most towns, were it not, as I have already stated, that we have to pump half our sewage and are also limited to capacity in joint trunk sewer. However, nearly all towns are either similarly situated or have purification plants which make it equally important to prevent infiltration owing to the additional cost of treating.

I would further state as my experience that in quicksand work or in any ground where

much water is encountered, it is not only better, but cheaper to use Jointite than cement if only sufficiently tight joints are desired to prevent quicksand entering through them. In all work at Summit I specify Jointite whether in wet ground or dry, as I consider it as important to prevent the sewage from getting out and polluting the subsoil, as to keep ground water from coming into the sewer.

Managing a Clay Bottom in a Tunnel.

Tunnel work for sewers, being usually near the surface, often encounters very troublesome obstacles in a combination of different materials, and sometimes in clays which seem to leave no foundation fit, or possible, to work on.

An interesting example from a piece of tunnel work in connection with the new sewerage work in Louisville, Ky., is given in the report of the chief engineer, J. B. F. Breed, and Harrison P. Eddy, of Boston, consulting engineer.

This was a tunnel nearly 1,300 feet long, the driving of which was made difficult, among other causes, by the variation in the depth of rock. In some places the headings were entirely in rock; in others entirely earth, while for about one-fourth of the distance the roof was in earth and the lower part of the tunnel was in rock. The method of construction adopted by the contractor was to first drive the entire length of tunnel between two shafts, then to start the concrete in the center of the drift, working in each direction toward the shafts. In the headings, which were wholly in earth, the wet, blue clay encountered was rendered soft and unstable by the continual disturbance caused by working upon it and by the passage of men and cars over it. This condition was avoided by building a sub-invert of concrete five inches in thickness as fast as the tunnel was driven and upon and over which the employes could work and pass back and forth without causing any softening of the material underneath.

In some places the clay was found to be particularly soft, so that the upward pressure of the clay in the floor of the tunnel, due to the weight of the surrounding material, caused some trouble in placing the concrete sub-invert. In such places a three-inch oak platform was placed on the clay bottom and on this the sewer was built. Under Mellwood avenue similar conditions were encountered and much trouble was experienced in attempting to drive a tunnel. The attempt to tunnel was finally abandoned and this portion was built in open cut, by which method no difficulty was experienced, apparently because of the reduced amount of walking over the clay bottom. In the open trench the clay was removed to a depth of twelve inches below grade, this excavation being refilled with gravel, which provided a satisfactory foundation for the concrete structure.

Sewer Construction in Lagrange, Ill.

The village of Lagrange, Ill., is just completing 6,500 feet of combined monolithic concrete and vitrified pipe sewer. The former of these is 6½ feet in diameter and will take care of storm water, while the smaller pipe, 15 inches in diameter, will carry sewage to the filter beds. These sewers parallel each other in the same trench, with their centers on practically the same plane.

The concrete sewer has walls 8 inches in thickness, and the concrete is extended to cover the pipe sewer to a thickness of 6 inches. This is done because the flow through this pipe is at a considerable head at some points.

The excavation is made with a 45-ton Bucyrus shovel, while a Vulcan traction shovel makes the back fill.

Concrete is mixed directly over the trench on a platform resting on rollers. The mixer outfit comprises an engine, a boiler and a Drake continuous mixer discharging through a swinging pipe directly into the forms. Concrete materials are distributed in piles at convenient intervals along the trench either in the street or on private property. From here it is delivered by wheel-barrows directly into the mixer.

About 130 feet of the sewer invert extending up on the sides to within a foot of the center line is poured before any attempt is made to place the arch. The platform is pulled ahead by a crab on the engine. Forms are then set up and the platform returned to pour the concrete into the arch. These forms consist of 2x6-inch lagging placed over ¾x3-inch steel half rings, which have their turned-in ends bolted together at the sides of the sewer. To facilitate removal, wedges were placed between the ends of the half rings. The lagging is 16 feet long and the rings are spaced 4 foot centers. A steel band 1-16x4 inches in cross-section, bent to the half circle with the ends turned in and back to hold the first plank secures the lagging in place at each side. The last piece placed at the top forms a key which is so wedged against the adjoining pieces that it can be removed quickly. Forms are left in from thirty to forty-eight hours. The contractor has sufficient lumber to set up about 500 feet of forms. From 130 to 160 feet of completed sewer constitutes an average day's work, except where a medium hard limestone ledge, varying in depth from 0 to 6.5 feet was encountered. Two men only are required to remove the forms and carry the material forward. Two other men erect the inner forms for the arch and also place the boards used on the haunches on the outside.

The invert of the sewer is given a plaster finish ¾ to 1 inch thick, applied as soon as the comparatively dry concrete has been placed. The arch is smoothed up with plaster where necessary as soon as the forms are removed.

The concrete used in constructing the sewer

is mixed in the proportions of one part Universal Portland cement to three parts torpedo sand and five parts of 1½-inch broken limestone obtained from quarries about one and one-half miles from the work.

The Ewing & Stone Company, of Chicago, are the engineers on the job, with Mr. Edwin Hancock, of that company, in active charge.

The Youngstown Slag Road.

To the Editor of MUNICIPAL ENGINEERING:

Sir—I note in the February issue of "MUNICIPAL ENGINEERING," on page 98, an article published as Editorial Correspondence and entitled "The Youngstown Slag Road." Taken as a whole, your correspondent gives a good review to date of the slag experiments conducted by this office in co-operation with the Carnegie Steel Company, but there is one erroneous statement to which I take occasion to call your attention in order that it may be corrected through your pages. I refer to your representative's report of an inspection of Section 40, on page 100, where he says:

The binding material, a crude coke-oven tar, seems to possess valuable properties for use in this connection, superior by far to most crude tars which have come to the writer's attention.

Then follows an analysis of a sample of the crude material with our recommendations as to the proper method of refining it to produce a satisfactory road binder.

For your correct information I am sending you herewith a copy of our circular describing the Youngstown experiments, and on page 9 you will find an analysis of the tar actually used with a brief statement showing that it was made from the crude material by following our recommendations. It was a refined product and your correspondent has evidently been misinformed; but since the wide circulation which this paragraph may have is apt to mislead your readers into attempting construction work with crude tars, and, moreover, places us in the position of recommending such tars for that class of work, I have to request that you make such prompt and public correction of the statement as you conventiently can.

L. W. PAGE,
Director, Office of Public Roads,
Washington, D. C.

The analysis to which Mr. Page refers is as follows:

This tar was obtained from a by-product coke-oven plant at Sharon, Pa., where it was also refined by distilling off about 17 per cent. of the lighter oils and water. Its characteristics are shown in the following table:

ANALYSIS OF REFINED COKE OVEN TAR.

Specific gravity 25°/25° C.....1.217
Float test at 32° C(time)....1 min. 25 sec.
Per cent. of free carbon (insoluble in CS2, aid tem.).....13.11

Distillation:	Per cent. by vol.	Per cent. by wt.
Water	0.0	0.0
First light oils to 110° C...	.0	.0
Second light oils 110°-170° C	b3.8	3.2
Dead oils 170°-270° C.....c	26.6	23.4
Pitch residue .....d	69.6	73.4
	100.0	100.0

b. Distillate practically solid when cold.
c. Distillate showed about one-third its volume precipitated solids when cold.
d. Pitch residue, hard, brittle, fairly lustrous.

The Mechanical Action of Calcium Chloride.

To the Editor of MUNICIPAL ENGINEERING:

Sir—A companion piece to your very valuable article in the February issue on "The Germicidal Value of Calcium Chloride," from Prof. M. L. Trowbridge, will, I trust, be found in a brief description of my observation of the mechanical action of this chemical, which I have found very different from the accepted belief, in the four years of experimental work I have just completed.

I started my labors under the prevailing supposition that calcium chloride was a soluble salt which would dissolve completely in water and so become lost through this process of dissolution. But a close observation soon led me to doubt this theory. The fact that this chemical is considerably heavier than water would seem, on the lines of gravity, to make it impossible for the heavier substance, chloride, to lift and flow with the lighter substance, water. The fact that the chemical, once properly incorporated in a road, did not seem to wash or lose its moisture-gathering and giving properties, soon confirmed the belief that the chemical was not moved by a flow of water unless this flow was strong enough to lift and carry away bodily the road substance and surface to which it was attached. With this discovery, I began to question the theory of dilution and to substitute that of saturation. This I found fitted my experience more nearly, and so I took a sample of the chemical to Prof. John Matthews, the chemist in one of the high schools of this city, and arranged with him to test out this sponge theory as against the old one of dilution. At first he was inclined to ridicule my beliefs and was doubtful of results, but on hearing the actual results, which I had observed in over a year's use of the chemical in road treatment, he agreed to make the tests for me. He, very much to his surprise, found my contentions correct and has recently made affidavit to this effect for presentation to the Commissioner of Patents in support of my contentions before that office.

Now, with the chemical heavier than water, and having the sponge property of absorption and evaporation, rather than that of dilution and dissolution, you can see that the chemical, once properly and thoroughly incorporated in the top surface of a roadway, becomes practically indestructible. As Prof. Trowbridge shows in his able paper, once such an incorporation is a fact, the roadway becomes sterile, and if you allow this chemical sponge to dry out and the surface of your roadway to become dry and dusty, still you will have

a relatively harmless dust, one carrying few, if any, disease germs.

I think I have also made still another discovery. In the chemical action of this chemical is a leech-like action of attachment by which it will attach itself to any substance it may fall upon in a liquid state, or on which it may dissolve and liquefy if put on in a granular form, and that, once attached, its removal is almost impossible. I first noted this in the saturation or liquefaction by air-moisture absorption of these granules in a steel-shell wheelbarrow from which we did our spreading in my first year's operation. The shell of this barrow became coated with the chemical to a thickness of over one-fourth of an inch, and this coating could only be removed with some sharp cutting tool, with a blow or pressure. This feature also adds greatly to the life and service of the chemical after application.

It must be apparent that with all these staying qualities, added to the disease destroying action shown to exist (with a proper treatment) in the paper quoted above, you have in the deliquescent chlorides (calcium, magnesium and sodium chlorides being in this same class, with magnesium chloride a greater moisture absorbent than calcium), a substance for road treatment that has no equal. Owing to these lasting, or non-wasting properties, you have a system of road treatment, repair, and construction that insures a constant improvement in same, with a rapidly decreasing cost, going almost to the vanishing point, and one that will stand any kind or condition of traffic, in fact, the heavier and harder, the better, as weight simply means a more solid compacting, and rubber auto tires simply iron down a damp surface.

There is still another feature of this chemical action that promises much comfort to the dweller on a treated roadway during the hot, sultry summer months, and that is the promise of a nice, cool air through the night after a light wetting in the evening, as the chemical, once saturated, will carry the moisture all night, and long into the next day, no matter how hot and dry it may be, and if there is moisture in the air to draw from, it will not dry out at all.

These actions are largely contrary to the generally accepted belief, but are hinted at by Prof. Trowbridge in his statement that the chemical, though subjected to an excessive dilution during a long or hard drain, will again concentrate on evaporation and so regain or recover its original strength. As I understand it, a substance that is subject to a large dilution, unless absolutely confined (which is impossible on a roadway), could hardly recover its original strength or properties, but if, as under my contention, it is not diluted but simply saturated, the water saturation may and will dry out and leave the body of chemical intact ready for repeated actions. Prof. Matthews does not think it loses its absorption powers in any great degree by this repeated action.

S. G. Howe,
Manager the Howe Chemical Road Co.,
Detroit, Mich.

Schedule of Professional Charges.

A schedule of charges for professional services of consulting and construction engineers has been prepared by a number of representative St. Louis engineers and endorsed by the Engineers' Club of St. Louis. The schedule follows:

The following schedule of charges is intended as a guide to engineers and their clients. It is adopted as representing fair and proper compensation for engineering services under the conditions stated, and is believed to conform to the established practice of the leading American engineers. We recognize the propriety of a per diem or percentage charge varying in amount according to the magnitude or importance of the work involved, or the experience and reputation of the engineer. We reserve the right to depart from the schedule at any time, if such action seems to us wise and proper.

1. For preliminary study and report upon a project, or examination of a project prepared by another engineer and report on same:

(a) Charges, $50 to $100 per day for the first two to ten days and $25 to $50 per day thereafter, plus all expenses, including salaries paid assistants, with an allowance of 25 per cent of such salaries for general office expenses.

(b) In lieu of the above, at the option of the engineer, a percentage charge varying from 1 to 2½ per cent.

2. For preliminary study, report and final detail drawings and specifications:

Charges same as under paragraph 1 (a), or, at the option of the engineer, a charge of 3½ per cent.

3. For preliminary study and report, preparing detail drawings and specifications, awarding contracts and acting in a general supervisory capacity during construction, including office consultation, but not including continuous supervision, inspection, testing or management—work costing $10,000 or more, 5 per cent.

For work costing less than $10,000 it is proper to charge a fee in excess of 5 per cent.

4. For full professional services and management including preliminary studies, detail drawings and specifications, awarding contracts, active and continuous supervision, testing and inspection, work costing $10,000 or more, 10 per cent.

For work costing less than $10,000 it is proper to charge a fee in excess of 10 per cent.

5. For investigations and reports involving questions in dispute and intended for use in connection with expert testimony:

Charges, a minimum fee or retainer of $100 to $500, or such larger amount as may be commensurate with the financial importance of the case or the labor involved, with per diem and expense charges as per paragraph No. 1 (a).

6. Where a per diem charge is made six hours of actual work shall be considered one day. While absent from the home city, however, or while attending court, each day of twenty-four hours or part of a day shall be considered one day, irrespective of the actual hours of time devoted to the case.

7. When charges are based on a percentage of the cost, the commissions as above are to be computed on the entire cost of the completed work, or on the estimated cost pending execution or completion. Payments shall be made to the engineer from time to time in proportion to the amount of work he has done.

8. Traveling expenses, as well as any expenses involved in the collection of the data necessary for the proper designing or planning of the structure or project, such as borings, soundings or other tests, and excepting only ordinary measurements and surveys, are to be paid by the client in addition to the commissions herein provided for.

9. When alterations or additions are made to contracts, drawings or specifications, or when services are required in connection with legal proceedings, failure of contractors, franchises or right-of-way a charge based upon the time and trouble involved shall be made for same, in addition to the commission herein provided for.

10. Drawings and specifications are to be considered the property of the engineer, but the client is entitled to receive one complete record copy of same upon payment of actual cost of making copies if no duplicate set is on hand.

Cost of Tar Binding and Water Binding of Roads.

Having received a few inquiries as to the treatment of roads with "Tarvia" binding and "tar" binding, and as to the cost over the ordinary water-bound system, I thought it would perhaps be useful to embody the particulars in a short paper for the information of other surveyors in various parts of the country. In doing this I take into consideration that at this period of the year the estimates are being prepared for road work to be carried out during the forthcoming season, and the question to consider is the advisability of adopting more up-to-date methods in the repairing and remetalling of road surfaces, and whether surveyors are to advise their councils to use a tar binder or still adhere to the old water-bound system. There are various materials on the market from which to choose, such as ordinary gasworks tar, distilled tar, Tarvia and other patent tar preparations. In these short notes I shall only treat upon two—that is, ordinary gasworks tar, with an addition of pitch, and Tarvia. I append the approximate cost for the treatment of roads with these two materials, and also by the water-bound system as carried out by me during the past season. Of course, the cost of the various materials and work will vary in different districts according to distance from quarries, station or wharf to the road to be remetalled, and the cost of manual labor, etc. The amount paid by me for men averages about 3s. 2d. per day of nine hours. Another point to be taken into consideration in estimating the cost is the thickness of metal applied, whether one ton of metal is to cover ten or twenty square yards, and also the size of metal used, whether 1¾ inch or upwards to 2½ inch gauge.

The method adopted by me in the treatment of the roads is as follows: The dry metal is evenly spread over the surface of the road to the required contour, and then lightly rolled with a 12-ton roller to press the stones into their position; the Tarvia or other binder is then applied evenly over the surface by means of a 2-gallon water can or spreader, so as to cover every stone. After this has been done, ½-inch chippings are spread over the surface to fill up the interstices (allowing about 15 tons to 100 tons of metal); 10 tons are applied after application of binder. The whole is then thoroughly well rolled and brought to a good surface, after which the remaining 5 tons of chippings are spread to fill up any small holes which may still be showing, and left for the traffic to grind in. It is needless to remark that fine, warm weather is essential to carry out the work successfully and at a minimum cost. I find it necessary to have three 40-gallon tar boilers to keep properly going, otherwise the roller is standing idle, and the men have no binder to go on with, or are waiting for it to boil. Tarvia needs heating to a temperature of about 180 degrees Fahrenheit, and it is essential that it should reach about this temperature, otherwise it will not cover the area estimated (which should be at least one square yard to one gallon of material), and the work will take longer. When using Tarvia, which is very viscid, and difficult to get out of the barrel through the bunghole, especially if the weather is cold, it will be found necessary to take out the head of the barrel. The way to do this, causing least damage to the cask, is to knock off the chine and second hoops, tap the staves outwards with a hammer, remove the head, replace the second hoop and tighten up by driving it on, then empty the contents. The barrel will, of course, have been placed on the platform (mentioned later) before removing the head. The tools required are a cooper's drift and and two cooper's gimlets. A platform should be erected at a convenient point by placing two or more barrels on end and laying strong planks on them, and the barrels may be un-

loaded on to the platform or on to the ground and rolled up as required on two strong planks.

Two pieces of iron should be placed on top of each tar boiler and the barrels upended on them. The platforms should be placed in a position so that in removing once each day the material will only have to be carried a convenient distance.

The section of roadway treated with Tarvia has been a complete success so far this winter, it being practically free from mud and dirt, except a little brought on by wheels of carts from adjoining fields. The cost, as shown, works out at about 1s. 6¾d. per yard, but I consider it can be done for 1s. 4d., given favorable weather. In carrying out my work I was handicapped by wet weather and by only having two tar boilers for half the time the work was in progress, but I hope next season to show that Tarvia binding can be carried out at the price mentioned.

In considering the cost, the question of scavenging and cleansing requires to be taken into account, as the amount spent this winter on the section treated as been practically nil, which would not have been the case with a water-bound road.

I experimented on a small area of about 366 square yards with ordinary gasworks tar, with an addition of pitch. This has been fairly satisfactory, and would, I believe, have been a complete success, but I found the men were not using enough pitch, and were not allowing the mixture to boil. It is very evident enough pitch must be used, and the mixture brought to boiling point. As an experiment I consider it satisfactory, and believe it possible to produce good results if the above precautions are taken. The costs of the various systems will be noted from the appended particulars. I hope in making these remarks something may be done to assist in bringing about a better form of road surface.

PARTICULARS OF TARVIA BINDING.

	£	s.	d.
Quantity of metal used, 402 tons 6 cwt.; 322 tons, 11 cwt. of 2½-inch granite	148	15	7
79 tons 17 cwt. of 3-inch rejections (making up sides)	27	5	8
53 tons 8 cwt. ½-inch granite chips	20	13	10
Steam roller hire, 15 days	14	13	0
Manual labor, 8 men 15 days	19	8	8
Carting all materials (approx.)	35	18	8
3,813 gal. Tarvia "B" at 4¼d.	67	10	6
Use of 95 barrels at 6d	2	7	6
Return carriage on barrels	3	6	11
Fuel for tar boiler	1	12	6
Fuel for roller	4	1	3
Allow for tools and use of boilers	1	5	0
	£346	19	1

Length treated, 825 linear yards.
Area treated, 4,400 square yards.
Square yards per ton of metal, 10.90.
Approximate cost per square yard, 1s. 6¾d., or 38 cents.

APPROXIMATE COST OF TAR BINDING.

	£	s.	d.
23 tons (approximate) 2½-inch broken granite	11	8	1
3 tons ½-inch chippings	1	3	3
1¼ days steam roller	1	2	6
Manual labor	1	10	0
280 gallons tar	2	6	8
3½ cwts. pitch		14	0
Fuel		10	0
Tools, etc.		2	0
Team labor	2	10	2
	£21	6	8

Area treated, 366 yards (approximate).
Cost per yard, 1s. 2d., nearly, or 28 1-3 cents.
Square yards per ton of metal, 16 yards.
The above figures are the maximum, as actual figures and particulars were not noted at the time, and I believe the actual cost to be less than this.

WATER-BOUND ROADS (ACTUAL FIGURES).

	£	s.	d.
80 tons 7 cwt. 2½-inch broken granite	39	16	10
21 tons 12 cwt. 3-in. rejections	9	12	7
6 tons ½-inch chippings	2	6	6
Binding		16	0
Manual labor, 4 days	4	6	11
Team labor and horse for water cart	8	4	7½
4 days steam roller	3	12	0
	£68	15	5½

Area treated, 1,372 yards.
Cost per square yard, 1s., or 24 1-3 cents.
Square yards per ton of metal, 13.5.

—G. BENSON CHILVERS, Engineer and Surveyor to the Oundle Urban District Council, in *The Surveyor and Municipal and County Engineer.*

Snow Removal in Indianapolis.

An exceptional winter was that of 1911-1912, is the concurrent opinion of the weather authorities, both of the goosebone school and of the government weather bureau. Municipalities have realized this fact and their various departments have been kept busy correcting the troubles caused by the extreme cold and snow. Waterworks departments report troubles with anchor ice at the intakes, frozen service pipes and mains; and in some few cases even sanitary sewers were blocked with solid ice. Fire departments have been called upon to contend with snow drifts which were impassable to the old type of fire apparatus and impeded even the high-powered auto trucks. Frozen hydrants have added to their troubles. The street cleaning departments have had their problems to contend with, which have thoroughly tested abilities.

In Indianapolis repeated snow falls through January and February have taxed the patience of the street cleaning department and have proved a drain upon the department's appropriation by reason of the extra force required to handle the snow on the downtown streets.

The government weather bureau records show a snow fall each week through January until the last week of the month, when the customary January thaw allowed the street department a slight breathing spell. For the first two weeks in February there was snow every day, ranging from a trace to 1.4 inches. Then on February 21st, came a storm which will make the winter remark-

able as the year of the big snow. It started with a sleet on the night of the 20th, which quickly changed to a damp snow driven by a 36-mile wind. The snow was drifted badly throughout the city. The government records show a snowfall of 10 inches on the 21st, one of the heaviest ever recorded by the local bureau.

The result was a blockading of almost all forms of traffic. Street cars were kept in operation over a few lines during the morning and an effort was made to keep the tracks clear. An antiquated form of snow plow with a revolving brush which threw the topmost layer of snow to one side, was operated up and down a few of the main lines in an effort to keep them in operation, while the less important ones were abandoned. By early evening there were only two car lines moved within three days from about 22,000 linear feet of 60 to 80-foot pavements.

The method of removal, while not by any means new, presents many points of merit. It was necessary, owing to the dampness and weight of the snow, to loosen it from the street surface and to place it in ridge piles for removal, so two graders, each drawn by six horses, were employed. The graders were driven close to the curb and the snow was piled towards the center, where, with that which had been thrown from the car tracks, it formed continuous mounds which were easy of access for loading. It was then loaded into dump wagons, enough men being employed so that there was little waiting for a load, and the driver in each case assisted in loading. A short haul of never more than a block was then made and the wagon was

I. SNOW REMOVAL IN INDIANAPOLIS.
Scraping and Loosening Snow.

in service, and except for an automobile bus line which operates regularly on Meridian street and a few privately owned automobiles and motor trucks which were being driven for hire, there was no traffic between the downtown and residence districts.

During the entire day the street cleaning department had been working with a force of 260 men endeavoring to keep the downtown streets in a passable condition. The heavy snowfall which had drifted to a depth of three or more feet at some points, was made worse by that which was thrown by the sweepers from the double tracks of the car lines, directly upon the portion allotted to vehicular traffic. Owing to the excessive and continued snowfall it was found impossible to extend the operations of the snow removal beyond the limits of the business and wholesale districts; but it is to the credit of the department that this district was not blockaded and that all of the snow was redumped directly over a manhole into a sewer, and that portion of the snow which did not fall directly into the manhole was shoveled into it. The three photographs accompanying show the different stages of the work.

There were a few minor details of handling the men and wagons which are perhaps open to criticism, but in the main the work was very efficient. It was evident that there was congestion at some points where 8 or more wagons were at work in one block as shown in photograph 1. They interfered with one another to some extent and it was noted that as they were driven to the manhole to be dumped, there were at times two or more wagons waiting their turn, while at other times the four or five men who were shoveling into the sewer would be left idle while they waited for a wagon. But with so large an unskilled organization gathered on such short notice, the work was creditably handled.

The regular barn force of the street clean-

II. SNOW REMOVAL IN INDIANAPOLIS.
Loading into Wagons.

ing department includes about 12 or 13 men, including the drivers, repair men, etc. The department owns about 45 wagons, of which number about 28 were available for the snow removal. The uniform scale of 20 cents per hour was paid to the regular and the extra men employed by the department. The following payrolls for January and February, furnished by J. C. Egger, of the street cleaning department, show the expense of snow removal during those months, for but little other work was done at that time:

January 3rd to 10th	$1,415
January 10th to 17th	1,900
January 17th to 24th	681
January 24th to 31st	552
January 31st to February 7th	849
February 7th to 14th	625
February 14th to 21st	891
February 21st to 28th	1,596
Total	$8,509

The total quantity of snow removed in January was 20,049 cubic yards, and in February was 24,339 cubic yards.

III. SNOW REMOVAL IN INDIANAPOLIS.
Shoveling into Sewer.

STREET · LIGHTING

Ornamental Luminous Arc Lamp.—Poughkeepsie's Lighting.—Dearborn Street Lights.—Ornamental Lighting.

The Luminous Arc Lamp in Ornamental Street Lighting.

The development of the magnetite or luminous arc lamp has been practically simultaneous with the growth and spread of ornamental street lighting. The fact that no attempt had been made, except for a very few exceptions, to render the arc light standards attractive, has caused the incandescent lamp to be adopted in the more modern examples of street lighting. A committee of the National Electric Light Association commented on this fact in a report to the association. Their comment was, briefly:

As regards arc lighting, there is very little which should properly be classified as ornamental. The fixtures employed are rather better than has been common in this country, but neither the fixtures nor the illumination would strike a visiting foreigner familiar with street lighting in continental cities as implying anything more than a workmanlike attempt to furnish adequate illumination in streets deserving it. They are indeed very few arc installations in this country which should properly be classified as ornamental lighting save in isolated spots. We may, therefore,, pass by the arc lighting matter as simply embodying vigorous efforts in the right direction without in any sense entering the field of decorative lighting.

The steadily increasing demand for a street lighting unit which is attractive in appearance by day as well as when lighted has led to the designing of an arc lamp, globe and standard which satisfies this demand. This unit is described in the General Electric Review, by C. A. B. Halvorson, Jr.

Photograph 1 is as illustration of the lamp mounted on one of these ornamental poles such as may be obtained from the various manufacturers. The lamp casing constitutes the capital of the supporting post or column, and is so designed that by releasing a latch it may be lowered to give free access to the lamp mechanism as readily as a similar operation is accomplished on an ordinary arc lamp.

As the lamp is designed to be operated from a series rectifier outfit, it is necessary to provide proper insulation from lamp to ground, as well as adequate protection for the trimmer.

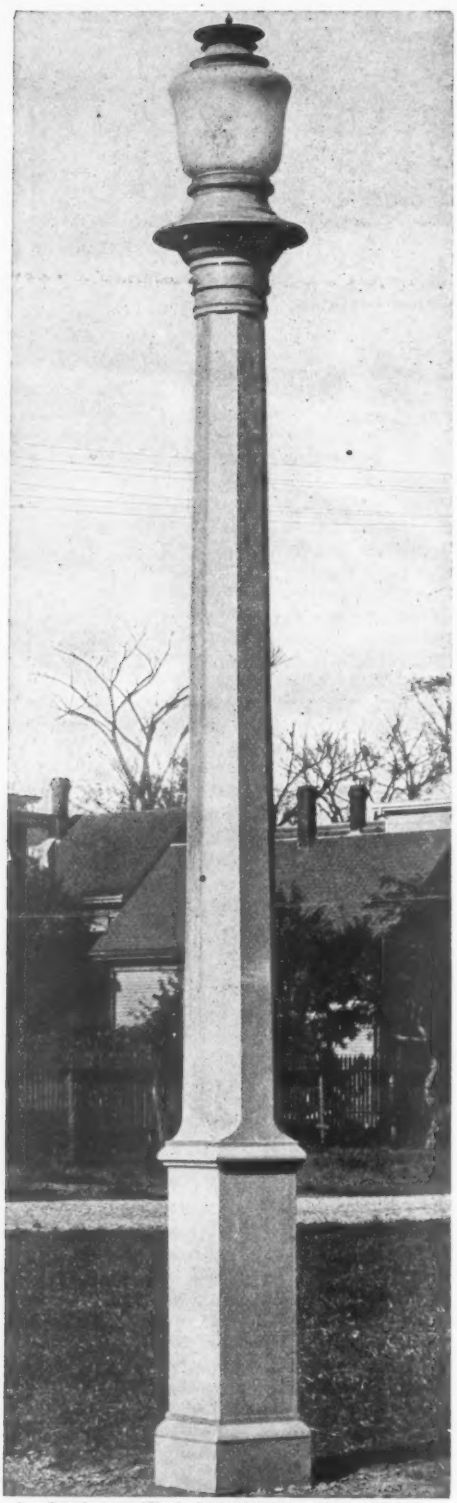
With this end in view the lamp is placed on a high voltage strain insulator which is fastened to the pole by three deeply recessed screws placed 120 degrees apart; the lamp being held to the insulator by three other recessed screws permanently secured to the insulation. The changing of the lamps for any purpose is easily accomplished by removing three nuts, the studs projecting upward and being held in place ready for the installation of the new lamp. The details of the installation are shown in photograph 2.

Within the base of the pole an absolute cut out is placed so that the trimmer may disconnect the lamp from the line before starting to work on it.

The ornamental cover of the chimney is also highly insulated from current carrying parts, and it is practically impossible for any ground to take place here. The insulator acts also as the globe seat.

In operation and design the mechanism is essentially the same as that of the standard mechanism of the direct current series luminous arc lamps. The arc is struck between a stationary non-consumable copper upper electrode and a movable magnetite lower electrode, 9-16 inch in diameter and 18 inches long, burning under normal updraft conditions The lower electrode is carried on a rod (photograph 3) actuated by the standard type of shoe clutch mechanism. The current is carried to the electrode by means of a flexible spiral connection contained in tube which is telescoped by the electrode rod. A single side rod, telescoping the supporting tube, supports and carries the electrode, fume dome and chimney so that no shadows on the globe are visible when the lamp is properly placed, with the side rod toward the sidewalk.

The lamp is equipped with a diffusing globe that is unique in design in that it is perfectly filled with light and no circular shadows are cast upon it by the electrodes. It is equipped with an attaching ring fitted



1. ORNAMENTAL LUMINOUS ARC LIGHT.

with bayonet slots, which are arranged so that by turning the globe on its axis it may be removed without disturbing the alignment of the electrodes. If, on the other hand, it is desired to raise the globe for cleaning, without removing it from the lamp, this may be accomplished by raising the globe and turning it on the axis of the supporting rod; the electrode box and globe being handled as a unit and supported in position by a locking arrangement located within the tube. A large ash pan is provided, which is easily removable.

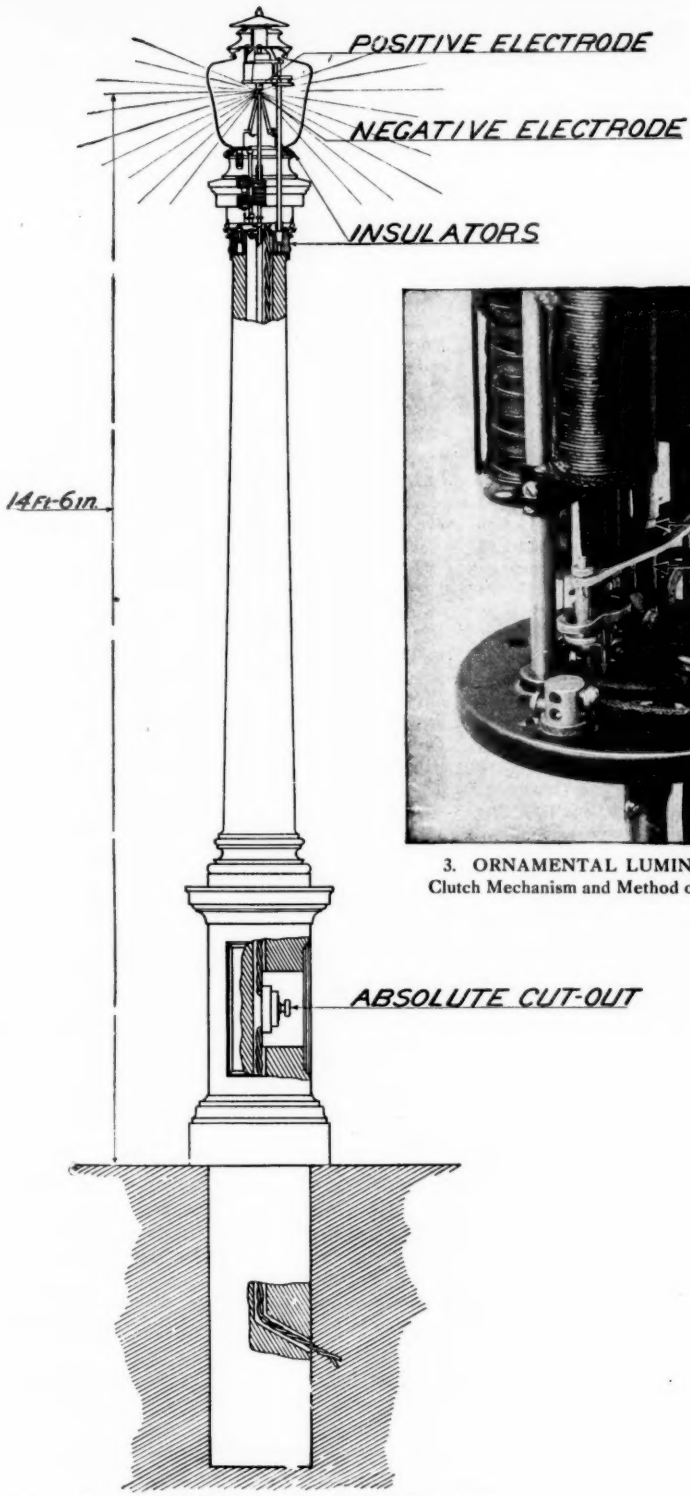
The operation may be stated as follows: The current enters a terminal, passing through the starting resistance, starting magnets, and the cutout contacts to the negative terminal. The starting coils are thus energized and the lower electrode is brought into contact with the positive, establishing the arc and the circuit through the series cutout coil; this coil, on becoming energized, separates the contacts and opens the circuit through the starting coils, thus allowing the lower electrode to fall back to its normal position, retarded by air dashpots. The electrodes remain in this position until for some reason the voltage at the arc momentarily reaches a point sufficiently high to actuate the shunt magnet, when the contacts are once more closed and the cycle of operation is repeated.

When operating at standard adjustments, the life of the lower, or magnetite, electrode is from 150 to 175 hours, and that of the upper, or copper electrode from 3,000 to 4,000 hours. The electrodes used being of the same composition as those used in the standard series luminous lamps, the illuminating efficiency at the arc should be the same; as, however, the lamp carries no reflector, a certain amount of light is directed upward and passes through the globe. The upward rays tend to obliterate finely-defined shadows, and are of great value to ornamental street lighting.

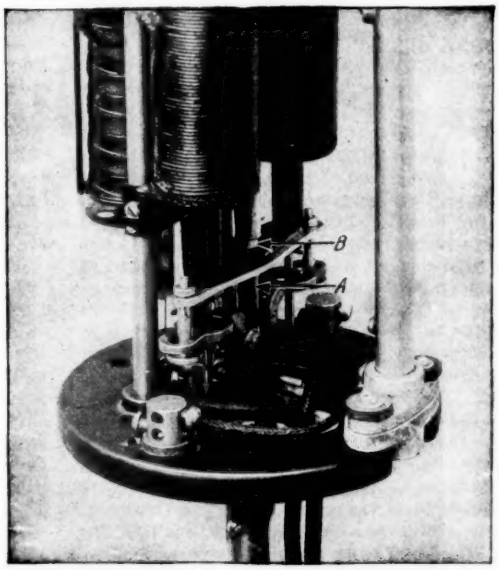
The first installation of this type of lamp was made in New Haven, Conn., and has been recently been put in service. The units are placed alternately and are spaced 87 feet apart. The first installation included 75 lamps which were located on the principal business streets. The wiring is all placed underground and each lamp is connected separately to a man-hole so as to provide for easy access for repairs.

The poles are of the design shown in photograph 1. Special provision is made to guard against grounding as noted in the previous description.

The new unit gives a light of a pure white color, so diffused as to give a minimum of glare. It is pleasing in appearance, efficient and particularly adapted to park and boulevard lighting.



2. ORNAMENTAL LUMINOUS ARC LIGHT.
Details of Installation.



3. ORNAMENTAL LUMINOUS ARC LIGHT.
Clutch Mechanism and Method of Connecting to Circuit.

FIRE AND WATER

Chemical Fire Extinguisher.—Lawton Water Works.—Motor Fire Engine.

Chemical Fire Extinguisher.

BY CHARLES H. MEIGS.

The extinguishing of large fires by means of water is a matter that has been fully developed. Steam pumps, motor-driven pumps and high-pressure systems may be further improved, but however the means and methods may be improved in fighting fire with water, the principle must always be the same and the endeavor must always be the same as at present—that is, to get an adequate volume of water in the proper place in the shortest possible time. It is absolutely true that if it were possible to get non-injurious fire-extinguishing chemical solutions in practically unlimited quantities and at not a prohibitive expense, the same as we now get water, plain water would never be used on fires. The impossibility of our doing this is the real reason and the only reason why all large fires are handled with plain water, for in these enlightened days we have every facility for knowing positively that chemical solutions are many times more efficient than plain water for fighting fire. And I wish to call your attention to another point that is not recognized by many, and that is that large fires are seldom extinguished by water. It is creditable if, by the use of water, we are able only to confine large fires to their place of origin. Large fires are never put out. They burn out, or nearly so, until they are small fires, and then are easily controlled by water. Even today reliable statistics prove that less than 20 per cent. of all fires are extinguished by means of water, over 80 per cent. being handled solely by chemical fire apparatus. Therefore we are well warranted, in considering fire extinguishing, in giving our attention to the subject of chemical fire apparatus; for it is only in chemical fire apparatus that any real improvement in the science of fire-fighting has been, or can be, made.

To be able to fight fire to the best advantage and to understand why one method of fighting fire is better than another we must know what fire is. "Fire," said Lavoisier in 1786, "is the combination of a substance with oxygen." To have fire, therefore, oxygen must be present with the material with which it is combining, and not only must they both be present—this oxygen and this material—but they must be present at a temperature above the burning point. So, then, two conditions are absolutely necessary before we can have fire. The burning point varies greatly in different substances. But all fire, whether it be the slow process of rust or the quicker process of a conflagration, when a building, a block, or a whole city, is a mass of flames, is simply the combination of some substance with oxygen.

As there are only two conditions that are requisite in order to have fire, it follows that there can be only two ways in which to extinguish fire. If it were practical in every instance the best and quickest way to extinguish any fire would be to separate the oxygen from the substance with which it is combining. They must be together and combine in order to produce fire; therefore, to separate them and to interfere with their combining is to extinguish the fire. That is the first way. The second way is to reduce the temperature below the burning point.

Water extinguishes fire because it reduces the temperature below the burning point by taking the heat of the fire and using it to change the water into steam; and it also, both by means of the steam and by itself, tends to form a blanket or covering over the burning material, thus separating it and shutting it off from the air (that is, from the oxygen in the air) and in that way extinguishing the fire.

The stream from chemical fire apparatus is much more efficient for fire-extinguishing purposes than is plain water because, first of all, this stream is water, and that fact is not changed because chemicals are carried in the solution. Therefore, the chemical stream does everything that the water stream does, exactly in the same way and for the same reason that water does it; and it does something that the water stream cannot do—that is, it forms a blanket of gases which are heavier than air, and which are non-supporters of combustion, and thus more effectively shuts off any access of air (oxygen) to the fire. You will note that something more is necessary than that these gases shall be heavier than air and thus act as a smothering blanket. They must also be non-supporters of combustion.

In the ordinary chemical fire apparatus

with which everybody is more or less familiar, known as the "soda-and-acid" type, a solution of bi-carbonate of soda is used, into which sulphuric acid is dumped. The heat of the resultant chemical action transforms the solution partially into carbonic acid gas (carbon dioxid, CO_2), and this gas is the fire-extinguishing principle—it being heavier than air and a non-supporter of combustion. The tank must be at least from one-fifth to one-seventh empty, to provide space for the collection of this gas which forms in larger volume than the space permits, and thus compresses itself, and in that way forms the pressure which forces the stream out of the chemical tank, through the hose and on the fire.

The practical and successful application of compressed air to chemical fire apparatus has marked an epoch in fire-fighting. There is no device in which the use of compressed air is so desirable and valuable, and to which it is so adaptable as chemical fire apparatus.

By this compressed air system the expense and handling of the sulphuric acid are entirely avoided. The pressure is powerful, always ready, reliable, uniform, entirely independent of any chemical action, and always the same under all conditions. This pressure, compressed air, is carried in separate, interchangeable air cylinders, connected to the chemical tank through an automatic pressure-reducing valve, which regulates and controls the pressure on the chemical tank, keeping it uniformly at whatever pressure is desired. As no gas space is required, the chemical tank can be filled to its capacity. As the pressure is not dependent upon any chemical action, the apparatus is not limited to any specific chemical solution, because the compressed air will, of course, force plain water, or any desired solution, out of the tank. This permits the addition of other chemicals that give increased fire-extinguishing and fireproofing qualities. The heat of the fire creates all the carbonic acid gas and other gases than can possibly be made from the full strength of all the chemicals, and all these gases are made on the fire. If only a portion of the contents of the chemical tank is used the remaining portion does not have to be wasted.

Its solution, having extinguished the fire, then fireproofs the material, so that it cannot readily catch fire again.

Public competitive tests of this apparatus have been given before firemen and others in such places as Wilkes-Barre, Pa.; Delmar, N. Y.; Washington, D. C.; Mt. Vernon, N. Y.; Boston, Mass.; Charleston, W. Va., and many other cities, and have demonstrated its reliability and efficiency.

The Water Supply System of Lawton, Okla.

The town of Lawton, Okla., was established and started by the United States government. The federal government platted the town, conducted the auction sale for the disposal of town lots, and expended the amount realized, nearly half a million dollars, for city and country improvements. This money paid for water mains, sanitary and storm sewer systems, school houses and running expenses of the city for a year. Court house, jail and many other improvements were provided, and thus was the young city able to start on its voyage unincumbered by bonded indebtedness.

Lawton's water supply is at present the most important feature. About fourteen miles northwest of the city is a high range of the Wichita mountains. The mountain heights culminate at the top of Mt. Scott, 3,400 feet above sea level. In early ages these mountains formed a complete circle, but the constant wash of water as it overflowed at a particular point made an outlet.

An early move of the city was to build a dam across this outlet. Ground was purchased and now that the dam is completed to a height of 50 feet, the city is assured of an abundance of water. The water is such as is found in mountain districts. More than 600 acres are now covered with water and the gauge shows that water is 34 feet deep. When the water reaches the top of the dam the lake will cover 1,500 acres.

The dam is a reinforced concrete structure, the base being 55 feet in width, the height is 50 feet and the length 325 feet. The dam in its present state cost $120,000; the pipe line into the city, $175,000, and the 2,300 acres which the city purchased to maintain the reservoir, $65,000.

In order that the supply of water would always remain in its present undefiled condition, Senator Thomas, of Lawton, was successful in getting through the State Legislature a bill giving the city of Lawton power to police sufficient country in that vicinity to control any drainage that would flow to the city lake.

The dam is 177 feet above the highest point in the city and 14 miles from the source of supply. This gravity system obviates the necessity of pumping station and steam engines. The power will later be utilized for commercial purposes.

New York's Powerful Motor Fire Engine.

What is said to be the most powerful fire-fighting machine in the world has just been placed in commission in connection with many changes inaugurated to perfect New York's fire defense system. The engine is of 26 h.p., gasoline automobile type and travels at the rate of 35 miles an hour. Pumps 744 gallons a minute. It is the expectation of the city authorities to have 150 motor-driven fire apparatus by the end of 1912. The weight of the engine is 13,000 pounds.

MUNICIPAL IMPROVEMENTS 1911-1912

CONSTRUCTION REPORTS FROM CITIES AND TOWNS

Streets, Sidewalks, Curb and gutter, Sewers, Sewage Disposal, Water Works, Electric Light, Gas, Garbage, Fire Apparatus and Buildings.

The promptness with which city officials have responded to our requests for information for this spring announcement of the work in prospect for the year 1912 enables us to give quite a full statement of the work of the past year as well as of the year to come, which can but be encouraging as an evidence of the prospects of prosperity in the near future and of plenty of work for every one interested in municipal developments. Perhaps the presidential election year has lost some of its terrors, perhaps the dangers of a change this year are not considered so serious as they have been sometimes, perhaps activity in municipal matters requiring many assistants is a convenience in campaign times. Whatever the reason there is plenty of work in sight, and the following pages give a good idea of what it is and where it is. The record of 1911 is given to indicate the increase or diminution in activity in the various cities and thus give additional light on the situation.

This special construction number is one month later this year than last because it is possible to make so much fuller report of the proposed work for the year than on any earlier date. The general form of the tables is similar to that used last year, with such changes as the changes in details of information supplied seem to require. They are arranged in the following order:

Street pavements.
Sidewalks,
Curb and gutter.
Sewers,
Sewage disposal.
Water distribution.
Water supply.
Electric light.
Gas light.
Garbage collection and disposal.
Street signs.
Fire department.

Nearly all city departments have responded to calls for information, but particularly city clerks, city engineers, boards of public works, water works, electric and gas lighting superintendents, and our acknowledgment of their courtesies is hearty and sincere.

The short time which can be devoted to the collection of these statistics that they may be both fresh and as inclusive of the prospects of the coming year as possible makes it impossible to get reports from every city, but the cities from which reports have been received are well distributed and are representative of all.

The usual department of "Improvement and Contracting News" is reduced to the statement of dates for receipt of bids and such general items as are not included in the larger tables and lists.

In all the tables and lists the cities are arranged alphabetically under their respective States, also arranged alphabetically.

In the line 1911 of the table is given the number of linear feet or the number of each class of work done or material furnished during the year 1911.

In the line 1912 is given like information regarding prospects for 1912. This line is printed in bold-faced type so that it can be readily distinguished, and at the same time can be easily compared with the line for 1911.

STREET IMPROVEMENTS.

Official Reports of Street Improvements Made to *Municipal Engineering* by Municipal Officials of America.

The data in the reports have been reduced to the same unit, linear feet of street, for ease in comparison. In case the data were given in square yards or square feet it is assumed that the average width of street is 30 feet. In cities which have been paving many alleys this average is probably a little too large, as the ordinary alley pavement is not more than 15 feet wide. In a very few of the larger cities this would result in the report of length of brick and concrete pavements being a little less than the actual fact.

Under "Asphalt' are included the few re-

ports of block asphalt as well as the sheet asphalt. Under "Granite" are included Belgian block, the ordinary granite block, sandstone and limestone blocks. Under "Concrete" are included Blome concrete, granitoid, Hassam and trappoid pavements. Under "Wood" are included wooden block and plank, most of those reported being creosoted blocks. Under "Bituminous Macadam" are included asphaltic concrete, asphaltic macadam, bitumen, bituminous macadam, filbertine, Ford macadam, gravel and oil, mineral rubber asphalt or concrete or Sarco mineral rubber, oileroid, oiled macadam, petrolithic, siliciamma, slag tar macadam, surface oil with and without surface coat of gravel, tar macadam, tarvia, westrumite and doubtless others whose trade names were not given in the reports.

Under "Others" will be found in the "1912" lines the total amount to be improved in 1912, in case the nature of the paving material to be used has not yet been decided upon. Where the other pavements in the city are classified, in either the 1911 or the 1912 lines, the figure under "Others" usually represents gravel.

ALABAMA.

City	Asphalt	Bitulithic	Bituminous	Brick	Concrete	Macadam	Granite	Wood	Others
Birmingham—									
1911	.....	18,992	15,151	12,121	.....	.....	.....	.....	.....
Corey—									
1911	.....	158	.....	.....	.....	.....	.....	.....	.....
Decatur—									
1911	.....	.....	3,500	.....	.....	.....	.....	.....	.....
1912	.....	.....	**1,200**	.....	.....	.....	.....	.....	.....
Dothan—									
1911	.....	.....	.....	5,416	.....	.....	.....	.....	.....
Florence—									
1911	.....	.....	.....	.....	.....	5,280	.....	.....	.....
Gadsden—									
1912	.....	.....	**6,000**	.....	.....	**15,840**	.....	.....	.....
Huntsville—									
1911	1,360	.....	19,800	10,560	15,840	79,000	.....	.....	.....
1912	**10,560**	.....	.....	.....	.....	.....	.....	.....	.....
Jasper—									
1911	.....	.....	.....	.....	.....	.....	.....	.....	15,800
Mobile—									
1911	.....	.....	.....	.....	.....	.....	.....	9,900	.....
Montgomery—									
1911	.....	.....	.....	.....	.....	.....	.....	9,900	.....
New Decatur—									
1911	.....	.....	15,000	.....	.....	.....	.....	.....	.....
1912	.....	.....	**32,000**	.....	.....	.....	.....	.....	.....
Selma—									
1911	.....	.....	.....	.....	.....	.....	.....	.....	.....
1912	.....	.....	.....	.....	.....	.....	.....	.....	**5,000**

ARIZONA.

Phoenix—									
1911	.....	6,847	.....	.....	.....	.....	.....	.....	.....

ARKANSAS.

Fayetteville—									
1911	.....	.....	.....	.....	.....	.....	.....	.....	10,500
Ft. Smith—									
1911	.....	.....	.....	52,800	.....	.....	.....	.....	.....
Helena—									
1912	.....	.....	**1,000**	**9,000**	.....	.....	.....	.....	.....
Little Rock—									
1911	.....	.....	.....	.....	.....	.....	.....	15,840	.....
Pine Bluff—									
1912	.....	.....	.....	.....	.....	.....	.....	.....	**8,000**

CALIFORNIA.

Alameda—									
1912	.....	.....	.....	.....	.....	**5,000**	.....	.....	.....
Alhambra—									
1911	.....	.....	53,900	oiled ...	.....	.....	.....	.....	.....
1912	.....	.....	**52,450**	**oiled** ...	.....	.....	.....	.....	.....
Berkeley—									
1911	4,200	.....	.....	.....	.....	21,900	.....	.....	.....
1912	**50,000**	**36,500**	**22,500**	.....	.....	**12,500**	.....	.....	.....
Chico—									
1912	**13,500**	.....	.....	.....	.....	.....	.....	.....	.....
Fresno—									
1911	.....	.....	3,330	.....	.....	.....	.....	.....	.....
1912	.....	.....	6,000	.....	.....	.....	.....	.....	.....
Grass Valley—									
1911	.....	.....	5,280	.....	.....	3,900	.....	.....	.....
Los Angeles—									
1911	67,000	.....	10,000	.....	.....	.....	5,000	.....	115,000
1912	.....	**10,000**	.....	.....	.....	.....	.....	.....	**117,000**
Marysville—									
1911	4,200	.....	.....	.....	.....	.....	.....	.....	.....
1912	**11,000**	.....	.....	.....	.....	.....	.....	.....	.....

City	Asphalt	Bitulithic	Bituminous	Brick	Concrete	Macadam	Granite	Wood	Others
Modesto—									
1911	25,000	.....	.....	.....	.....	.....	.....	.....	.....
1912	**30,000**	.....	.....	.....	.....	.....	.....	.....	.....
Pasadena—									
1911	.....	13,800	.....	.....	.....	.....	.....	.....	.....
Riverside—									
1911	70	.....	.....	.....	.....	531	.....	.....	.....
Sacramento—									
1911	.....	15,500	57,700	.....	.....	.....	.....	.....	.....
1912	**15,840**	.....	**57,700**	.....	.....	.....	.....	.....	.....
San Bernardino—									
1911	2,640	.....	13,200	.....	.....	.....	.....	.....	31,680
1912	**2,640**	.....	**21,120**	.....	.....	.....	.....	.....	31,680
San Francisco—									
1911	30,965	.....	54,050	.....	.....	29,900	7,557	.....	1,132
1912	.....	.....	.....	.....	.....	.....	.....	.....	5,000
San Jose—									
1911	8,500	.....	1,600	.....	.....	.....	.....	.....	.....
1912	**26,400**	.....	.....	.....	.....	.....	.....	.....	.....
San Mateo—									
1912	**5,000**	.....	.....	.....	.....	**52,800**	.....	.....	.....
San Rafael—									
1911	.....	.....	.....	.....	.....	30,000	.....	.....	.....
1912	.....	.....	**12,400**	.....	.....	.....	.....	.....	.....
Santa Barbara—									
1911	1,060	.....	2,640	.....	.....	.....	.....	.....	.....
1912	**10,560**	.....	.....	.....	.....	.....	.....	.....	.....
Santa Cruz—									
1911	.....	.....	.....	.....	.....	2,640	.....	.....	.....
1912	.....	.....	**6,000**	.....	.....	.....	.....	.....	.....
Selma—									
1912	**10,000**	.....	.....	.....	.....	.....	.....	.....	.....
Stockton—									
1911	.....	.....	16,460	.....	1,720	16,290	.....	.....	600
1912	**400**	.....	**39,700**	.....	**2,400**	.....	.....	.....	.....
Vallejo—									
1911	7,500	.....	5,000	.....	.....	.....	.....	.....	.....
1912	**20,000**	.....	**20,000**	.....	.....	.....	.....	.....	.....
COLORADO.									
Boulder—									
1911	.....	.....	2,260	.....	.....	.....	.....	.....	7,200
1912	.....	.....	.....	.....	**2,640**	.....	.....	.....	.....
Florence—									
1912	.....	.....	.....	.....	.....	.....	.....	.....	**2,640**
Golden—									
1912	.....	.....	.....	.....	**650**	.....	.....	.....	.....
Grand Junction—									
1911	.....	.....	.....	.....	5,200	.....	.....	.....	.....
1912	.....	.....	.....	.....	**7,500**	.....	.....	.....	.....
CONNECTICUT.									
Ansonia—									
1911	.....	.....	.....	.....	.....	1,200	.....	.....	.....
1912	.....	**435**	.....	.....	.....	**2,000**	**600**	.....	**9,600**
East Hartford—									
1911	.....	.....	.....	.....	.....	8,000	.....	.....	.....
1912	.....	.....	.....	.....	.....	**2,400**	.....	.....	.....
Greenwich—									
1912	.....	**5,200**	.....	.....	.....	.....	.....	**510**	.....
Hartford—									
1911	2,640	.....	7,100	.....	.....	15,000	.....	200	.....
1912	**2,640**	.....	.....	.....	.....	**20,000**	.....	.....	.....
Meriden—									
1911	.....	.....	400	.....	.....	.....	.....	.....	.....
New Britain—									
1911	.....	.....	.....	.....	.....	.....	.....	.....	5,400
New Haven—									
1911	.....	.....	.....	.....	.....	.....	.....	3,900	.....
New London—									
1911	.....	.....	8,300	1,600	.....	.....	.....	.....	.....
Norwalk—									
1911	.....	.....	.....	.....	.....	.....	.....	6,000	.....
Norwich—									
1911	.....	.....	1,080	900	.....	5,200	2,000	.....	7,500
1912	.....	.....	.....	**900**	.....	**1,890**	.....	.....	**50,000**
Simsbury—									
1911	.....	.....	.....	.....	.....	2,000	.....	.....	.....
1912	.....	.....	.....	.....	.....	**2,000**	.....	.....	.....
Southington—									
1911	.....	.....	.....	.....	.....	800	.....	.....	.....
Stanford—									
1911	.....	.....	.....	.....	.....	.....	.....	600	.....
Torrington—									
1911	.....	.....	1,100	.....	.....	24,000	.....	.....	.....
1912	.....	.....	**1,935**	.....	.....	.....	**40**	.....	**2,460**

City	Asphalt	Bitulithic	Bituminous	Brick	Concrete	Macadam	Granite	Wood	Others
Wallingford—									
1911	.....	.....	2,640	.....	.....	.....	.....	.....	.....
1912	.....	.....	**4,500**	**1,500**	.....	**4,500**	.....	**1,500**	.....
Waterbury—									
1911	.....	.....	.....	4,214	.....	6,769	422	736	.....
DELAWARE.									
Milford—									
1911	.....	.....	.....	.....	600	.....	.....	.....	.....
1912	.....	.....	.....	.....	**600**	.....	.....	.....	.....
Wilmington—									
1911	.....	1,900	6,870	.....	1,120	.....	730	.....	.....
1912	.....	.....	.....	.....	.....	.....	.....	.....	52,800
DISTRICT OF COLUMBIA.									
Washington—									
1911	6,912	.....	.....	.....	.....	13,032	.....	.....	.....
1912	**8,700**	.....	**7,500**	.....	.....	**7,500**	.....	.....	.....
FLORIDA.									
Gainesville—									
1911	.....	.....	5,900	.....	.....	.....	.....	.....	.....
1912	.....	.....	.....	**10,000**	.....	.....	.....	.....	.....
Live Oak—									
1912	.....	.....	.....	**5,000**	.....	.....	.....	.....	.....
Palatka—									
1911	.....	.....	.....	12,000	.....	.....	.....	.....	.....
1912	.....	.....	.....	**3,000**	.....	.....	.....	.....	**6,150**
Pensacola—									
1911	.....	.....	.....	.....	.....	.....	.....	21,000	.....
1912	.....	.....	.....	**22,500**	**10,500**	.....	.....	**21,000**	.....
St. Augustine—									
1912	.....	.....	.....	**5,000**	.....	.....	.....	.....	.....
St. Petersburg—									
1911	.....	.....	.....	58,000	.....	.....	.....	.....	15,840
1912	.....	.....	.....	**26,400**	.....	.....	.....	.....	**5,280**
GEORGIA.									
Albany—									
1912	.....	.....	**6,000**	.....	.....	.....	.....	.....	.....
Americus—									
1911	.....	.....	.....	720	.....	.....	.....	10,800	.....
1912	.....	.....	.....	.....	.....	.....	.....	.....	**9,000**
Atlanta—									
1911	.....	17,900	.....	.....	.....	.....	.....	10,500	.....
Columbus—									
1911	.....	.....	27,552	22,305	.....	.....	.....	.....	.....
1912	.....	.....	**3,500**	**30,000**	.....	.....	.....	.....	.....
Dublin—									
1911	.....	.....	.....	10,000	.....	.....	.....	.....	.....
Newman—									
1911	.....	.....	.....	.....	.....	.....	.....	4,000	.....
Rome—									
1911	.....	.....	3,500	1,600	.....	.....	.....	3,900	.....
1912	.....	.....	**2,600**	.....	.....	.....	.....	**1,700**	.....
Waycross—									
1911	.....	.....	.....	.....	.....	.....	.....	.....	21,120
1912	.....	.....	.....	**1,200**	.....	.....	.....	.....	.....
IDAHO.									
Boise—									
1911	7,480	.....	8,300	.....	3,765	.....	.....	.....	.....
Lewiston—									
1912	.....	.....	.....	.....	.....	.....	.....	.....	**5,000**
Moscow—									
1912	.....	.....	.....	.....	.....	.....	.....	.....	**10,000**
Payette—									
1912	.....	.....	.....	.....	.....	**26,400**	.....	.....	.....
Pocatello—									
1912	.....	**9,600**	.....	.....	.....	.....	.....	.....	.....
ILLINOIS.									
Aledo—									
1912	.....	.....	**24,090**	.....	**24,090**	.....	.....	.....	.....
Alton—									
1911	.....	.....	.....	12,840	.....	.....	.....	.....	.....
1912	.....	.....	.....	**19,200**	.....	.....	.....	.....	.....
Aurora—									
1912	.....	.....	.....	.....	.....	.....	.....	.....	**16,000**
Belvidere—									
1911	.....	.....	.....	.....	.....	8,000	.....	.....	.....
1912	.....	.....	.....	.....	.....	**some**	.....	.....	.....
Bloomington—									
1912	.....	.....	.....	**10,560**	.....	.....	.....	.....	.....
Cairo—									
1912	.....	.....	.....	**some**	.....	.....	.....	.....	.....

City	Asphalt	Bitulithic	Bituminous	Brick	Concrete	Macadam	Granite	Wood	Others
Canton—									
1911	.....	.....	.....	4,500	.....	.....	.....	.....	.....
1912	.....	.....	.....	**5,000**	.....	.....	.....	.....	.....
Carlinville—									
1912	.....	.....	.....	**360**	**1,140**	.....	.....	.....	.....
Centralia—									
1912	.....	.....	**6,000**	**6,000**	.....	.....	.....	.....	.....
Chicago—									
1911	288,000	.....	21,000	141,000	2,800	74,000	40,000	71,000	.....
1912	**285,000**	.....	**12,000**	**141,000**	**3,000**	**75,000**	**40,000**	**72,000**	.....
Chicago Heights—									
1911	.....	.....	10,560	15,840	.....	13,200	.....	.....	.....
Chrisman—									
1912	.....	.....	.....	**4,000**	.....	.....	.....	.....	.....
Collinsville—									
1911	.....	.....	6,600	.....	.....	.....	.....	.....	.....
Danville—									
1911	.....	2,900	.....	3,000	.....	.....	.....	.....	.....
1912	.....	.....	.....	**15,000**	.....	.....	.....	.....	.....
Decatur—									
1911	.....	.....	.....	7,920	.....	.....	.....	.....	.....
1912	.....	.....	.....	**3,600**	.....	.....	.....	.....	.....
Dekalb—									
1911	.....	.....	.....	.....	.....	.....	.....	.....	1,600
East Moline—									
1912	.....	.....	.....	**4,000**	.....	.....	.....	.....	.....
East St. Louis—									
1911	.....	.....	.....	64,500	.....	.....	.....	.....	.....
Edwardsville—									
1911	.....	.....	.....	5,280	.....	.....	.....	.....	.....
1912	.....	.....	.....	**7,700**	**4,100**	.....	.....	.....	.....
Elgin—									
1911	.....	.....	.....	306	.....	.....	.....	.....	.....
1912	.....	.....	**9,942**	**4,671**	.....	.....	.....	.....	.....
Eureka—									
1911	.....	.....	.....	2,640	.....	.....	.....	.....	.....
Evanston—									
1911	.....	.....	2,200	2,200	800	2,000	.....	.....	.....
1912	.....	.....	**1,700**	**1,400**	**2,000**	.....	.....	.....	.....
Forest Park—									
1911	.....	.....	.....	4,100	.....	.....	.....	.....	.....
1912	.....	.....	.....	**24,760**	.....	.....	.....	.....	.....
Freeport—									
1911	.....	.....	.....	.....	.....	7,010	.....	.....	.....
1912	.....	.....	.....	**8,340**	.....	.....	.....	.....	.....
Galesburg—									
1911	.....	.....	.....	3,500	.....	.....	.....	.....	.....
1912	.....	.....	.....	.....	.....	.....	.....	.....	**20,000**
Galva—									
1912	.....	.....	.....	**2,700**	.....	.....	.....	.....	.....
Granite City—									
1911	.....	.....	.....	3,500	.....	.....	.....	.....	.....
Greenville—									
1911	.....	.....	.....	.....	2,550	9,240	.....	.....	.....
1912	.....	.....	.....	.....	**2,340**	.....	.....	.....	.....
Harrisburg—									
1912	.....	.....	.....	.....	**5,000**	.....	.....	.....	.....
Harvard—									
1912	.....	.....	.....	**7,800**	.....	.....	.....	.....	.....
Harvey—									
1911	.....	.....	.....	5,700	.....	.....	.....	.....	.....
Highland Park—									
1911	.....	.....	8,400	.....	.....	1,170	.....	.....	.....
1912	.....	.....	.....	.....	**6,900**	.....	.....	.....	.....
Hillsboro—									
1912	.....	.....	.....	**6,000**	.....	.....	.....	.....	.....
Jacksonville—									
1911	13,200	.....	.....	.....	.....	.....	.....	.....	.....
Jerseyville—									
1912	.....	.....	.....	**9,000**	.....	.....	.....	.....	.....
Joliet—									
1911	.....	.....	.....	.....	.....	2,700	.....	.....	.....
1912	.....	.....	.....	.....	.....	.....	.....	**4,000**	.....
Lake Forest—									
1911	.....	.....	5,400	.....	.....	.....	.....	.....	.....
1912	.....	.....	**4,500**	.....	**7,340**	.....	.....	.....	.....
Lewiston—									
1912	.....	.....	.....	.....	.....	.....	.....	.....	**10,000**
Lincoln—									
1912	.....	.....	.....	**11,880**	.....	.....	.....	.....	.....
Marengo—									
1912	.....	.....	.....	.....	.....	.....	.....	.....	**Some**
Marion—									
1911	.....	.....	262	2,112	.....	.....	.....	.....	.....
1912	.....	.....	**3,180**	.....	.....	.....	.....	.....	.....
Marshall—									
1912	.....	.....	.....	**4,000**	.....	.....	.....	.....	.....

City	Asphalt	Bitulithic	Bituminous	Brick	Concrete	Macadam	Granite	Wood	Others
Mattoon—									
1911	.....	.....	.....	5,300	1,800	.....	.....	.....	.....
1912	.....	.....	.....	**15,000**	.....	.....	.....	.....	.....
Maywood—									
1911	.....	.....	.....	17,650	.....	.....	.....	.....	.....
1912	.....	.....	.....	**2,640**	.....	.....	.....	.....	.....
Melrose Park—									
1912	.....	.....	.....	**2,640**	.....	.....	.....	.....	.....
Mendota—									
1912	.....	.....	.....	**3,400**	.....	.....	.....	.....	.....
Moline—									
1911	.....	.....	.....	13,800	.....	.....	.....	.....	.....
1912	**9,300**	.....	.....	**12,600**	.....	.....	.....	.....	.....
Monmouth—									
1912	.....	.....	.....	**6,120**	.....	.....	.....	.....	.....
Morris—									
1912	**2,640**	.....	.....	**2,985**	.....	.....	.....	.....	.....
Morrison—									
1911	6,253	.....	.....	3,900	.....	.....	.....	.....	.....
Mt. Carmel—									
1911	.....	.....	.....	6,700	.....	.....	.....	.....	.....
1912	.....	.....	.....	**18,700**	.....	**3,500**	.....	.....	.....
Normal—									
1911	.....	.....	.....	8,100	.....	.....	.....	.....	.....
1912	.....	.....	.....	**5,100**	.....	.....	.....	.....	.....
Oak Park—									
1911	.....	.....	4,794	738	.....	6,567	.....	.....	.....
1912	.....	.....	**9,300**	**8,000**	.....	**2,600**	.....	.....	.....
Ottawa—									
1912	.....	.....	.....	**8,000**	.....	.....	.....	.....	.....
Paris—									
1911	.....	.....	.....	2,410	.....	.....	.....	.....	.....
1912	.....	.....	.....	**3,400**	.....	.....	.....	.....	.....
Pekin—									
1911	.....	.....	4,500	4,000	.....	.....	.....	.....	.....
1912	.....	.....	.....	**18,000**	.....	.....	.....	.....	.....
Peoria—									
1911	.....	.....	.....	.....	.....	.....	.....	1,500	.....
Pontiac—									
1911	.....	.....	.....	3,000	.....	.....	.....	.....	.....
1912	.....	.....	.....	**3,000**	.....	**1,950**	.....	**1,350**	.....
Proviso—									
1911	.....	.....	.....	.....	.....	2,650	.....	.....	.....
Quincy—									
1912	.....	.....	.....	.....	.....	.....	.....	.....	**20,000**
River Forest—									
1911	.....	.....	6,760	.....	.....	.....	.....	.....	.....
1912	.....	.....	**4,650**	**4,770**	.....	.....	.....	.....	.....
Robinson—									
1911	.....	.....	.....	3,500	.....	.....	.....	.....	.....
1912	.....	.....	**6,000**	.....	.....	.....	.....	.....	.....
Rochelle—									
1911	.....	.....	.....	15,000	.....	.....	.....	.....	.....
1912	.....	.....	.....	**9,495**	.....	.....	.....	.....	.....
Rockford—									
1911	.....	.....	17,000	4,600	.....	.....	.....	.....	.....
1912	.....	.....	.....	**14,000**	.....	.....	.....	.....	.....
Rock Island—									
1912	**7,500**	.....	.....	**4,800**	.....	.....	.....	.....	.....
Springfield—									
1911	660	.....	.....	17,700	.....	.....	.....	.....	.....
1912	**4,500**	.....	.....	**19,500**	**300**	.....	.....	**4,000**	.....
Spring Valley—									
1912	.....	.....	.....	**10,500**	.....	.....	.....	.....	.....
Sterling—									
1912	.....	.....	.....	**2,400**	.....	.....	.....	.....	.....
Streator—									
1911	.....	.....	.....	6,900	.....	.....	.....	.....	.....
1912	.....	.....	.....	**6,900**	.....	.....	.....	.....	.....
Taylorville—									
1911	.....	.....	.....	4,224	.....	.....	.....	.....	.....
1912	.....	.....	.....	.....	.....	.....	.....	.....	**10,000**
Urbana—									
1912	.....	.....	.....	.....	.....	.....	.....	.....	**15,000**
Vandalia—									
1912	.....	.....	.....	**5,200**	.....	.....	.....	.....	.....
Waukegan—									
1911	.....	.....	6,900	465	.....	5,300	.....	.....	.....
1912	.....	.....	**1,000**	**7,200**	.....	.....	**3,000**	.....	.....
Wheaton—									
1912	.....	.....	**10,560**	.....	.....	.....	.....	.....	.....
Woodland—									
1912	.....	.....	.....	.....	.....	.....	.....	.....	**Some**
				INDIANA.					
Anderson—									
1911	.....	.....	1,725	6,315	.....	.....	.....	.....	938

City	Asphalt	Bitulithic	Bituminous	Brick	Concrete	Macadam	Granite	Wood	Others
Attica—									
1912	.....	.....	.....	**3,900**	.....	.....	.....	.....	.....
Auburn—									
1911	.....	.....	.....	300	.....	.....	.....	.....	.....
Bedford—									
1911	.....	.....	.....	2,400	.....	.....	.....	.....	.....
1912	.....	.....	.....	.....	.....	.....	.....	.....	**5,280**
Bloomington—									
1911	.....	.....	.....	3,000	.....	3,000	.....	.....	.....
1912	.....	.....	.....	**7,500**	.....	**1,500**	.....	.....	.....
Bourbon—									
1912	.....	.....	.....	**10,000**	.....	.....	.....	.....	.....
Butler—									
1911	.....	.....	.....	.....	.....	.....	.....	.....	700
Clinton—									
1912	.....	.....	.....	**6,000**	.....	**6,000**	.....	.....	.....
Columbus—									
1911	.....	.....	.....	25,100	.....	.....	.....	.....	.....
Crawfordsville—									
1911	.....	.....	.....	4,000	.....	.....	.....	.....	.....
Delphi—									
1911	.....	.....	.....	6,120	1,658	.....	.....	.....	.....
1912	.....	.....	.....	**15,000**	.....	.....	.....	.....	.....
E. Chicago—									
1911	.....	.....	.....	19,220	5,800	.....	1,200	.....	.....
Elkhart—									
1912	**1,000**	.....	.....	**10,000**	.....	.....	.....	.....	.....
Evansville—									
1911	.....	.....	.....	.....	.....	.....	.....	.....	14,000
Ft. Wayne—									
1911	10,237	.....	7,759	12,301	.....	.....	.....	.....	565
1912	**13,000**	.....	**2,000**	**14,000**	.....	.....	.....	.....	.....
Goshen—									
1912	.....	.....	.....	**10,000**	.....	.....	.....	.....	.....
Greencastle—									
1911	.....	.....	.....	.....	.....	3,000	.....	.....	.....
Huntington—									
1911	.....	.....	2,400	.....	450	.....	.....	.....	.....
1912	**4,200**	.....	.....	.....	**1,800**	.....	.....	.....	.....
Indianapolis—									
1911	31,667	.....	3,681	10,040	.....	.....	.....	420	.....
1912	**40,000**	.....	.....	.....	.....	.....	.....	.....	.....
Kokomo—									
1911	3,565	.....	4,340	3,500	.....	2,200	.....	.....	.....
1912	**3,800**	.....	**11,690**	**8,000**	.....	.....	.....	.....	.....
Lebanon—									
1911	.....	.....	.....	966	.....	.....	.....	.....	2,640
Ligonier—									
1911	.....	.....	.....	5,280	.....	.....	.....	.....	.....
1912	.....	.....	.....	**2,640**	.....	.....	.....	.....	.....
Linton—									
1911	.....	.....	.....	1,500	.....	.....	.....	.....	.....
1912	.....	.....	.....	**7,920**	.....	.....	.....	.....	.....
Logansport—									
1911	16,873	.....	.....	2,200	.....	.....	.....	.....	5,400
1912	.....	.....	.....	**6,000**	.....	.....	.....	.....	**6,000**
Marion—									
1911	.....	.....	.....	1,504	.....	148	.....	.....	585
Martinsville—									
1911	.....	.....	.....	10,560	.....	.....	.....	.....	.....
Mishawaka—									
1911	670	6,340	.....	5,280	.....	.....	.....	.....	.....
1912	**670**	**6,340**	.....	**5,480**	.....	.....	.....	.....	.....
Mt. Vernon—									
1912	**600**	.....	.....	**600**	.....	.....	.....	.....	.....
Muncie—									
1911	.....	.....	.....	10,292	3,213	4,500	.....	.....	.....
1912	.....	.....	.....	**4,500**	.....	.....	.....	.....	.....
New Albany—									
1911	.....	.....	.....	280	.....	.....	.....	.....	.....
1912	.....	.....	.....	**1,950**	.....	.....	.....	.....	.....
Newcastle—									
1911	.....	.....	.....	7,500	.....	.....	.....	.....	.....
1912	.....	.....	.....	**14,768**	.....	.....	.....	.....	.....
Noblesville—									
1911	.....	.....	.....	9,900	.....	.....	.....	.....	30,000
N. Vernon—									
1911	.....	.....	.....	.....	.....	10,560	.....	.....	.....
Peru—									
1911	.....	.....	.....	4,000	.....	6,000	.....	.....	.....
Portland—									
1912	.....	.....	.....	.....	.....	**1,500**	.....	.....	**3,000**
Princeton—									
1912	.....	.....	.....	**10,000**	.....	.....	.....	.....	.....
Remington—									
1911	.....	.....	.....	.....	.....	52,800	.....	.....	.....
Richmond—									
1911	.....	.....	.....	3,964	3,091	10,000	.....	.....	1,916
1912	.....	.....	.....	**8,000**	.....	**10,000**	.....	.....	.....

City	Asphalt	Bitulithic	Bituminous	Brick	Concrete	Macadam	Granite	Wood	Others
Rushville—									
1911	.....	.....	.....	4,300	.....	.....	.....	.....	.....
Seymour—									
1911	.....	.....	.....	.....	600	.....	.....	.....	.....
1912	.....	.....	.....	**1,000**	**5,000**	.....	.....	.....	.....
Shelbyville—									
1912	.....	.....	.....	**9,500**	.....	.....	.....	.....	.....
South Bend—									
1911	.....	.....	5,280	1,700	.....	.....	.....	.....	.....
1912	**2,280**	.....	.....	**17,000**	.....	.....	.....	.....	.....
South Whitley—									
1912	.....	.....	.....	**6,000**	.....	.....	.....	.....	.....
Veedersburg—									
1911	.....	.....	.....	2,000	.....	15,840	.....	.....	.....
Wabash—									
1911	8,051	.....	.....	1,000	.....	2,800	.....	.....	.....
1912	**2,000**	.....	.....	.....	.....	.....	.....	.....	.....
Warsaw—									
1911	5,280	.....	.....	.....	.....	.....	.....	.....	.....
Washington—									
1911	.....	.....	.....	.....	.....	1,740	.....	.....	1,440
W. Lafayette—									
1912	.....	.....	**3,000**	.....	.....	.....	.....	.....	.....
Whiting—									
1911	4,611	.....	580	.....	.....	565	.....	.....	.....
1912	.....	.....	**12,000**	.....	.....	.....	.....	.....	.....
				IOWA.					
Ames—									
1911	.....	.....	.....	.....	.....	.....	.....	2,000	.....
Belle Plaine—									
1911	.....	.....	.....	.....	.....	.....	.....	.....	9,600
Burlington—									
1911	.....	.....	500	972	1,203	.....	.....	.....	.....
Carroll—									
1911	.....	.....	.....	4,500	.....	.....	.....	.....	.....
1912	.....	.....	.....	**7,200**	.....	.....	.....	.....	.....
Cedar Falls—									
1912	**4,800**	.....	.....	.....	**17,200**	.....	.....	.....	.....
Cedar Rapids—									
1911	.....	.....	.....	15,000	650	.....	.....	2,200	.....
Chariton—									
1911	.....	.....	360	5,700	.....	.....	.....	.....	.....
Charles City—									
1912	**6,336**	**6,336**	or	**6,336**	**6,336**	or	.....	**6,336**	.....
Clarinda—									
1911	.....	.....	.....	.....	4,500	.....	.....	.....	.....
Clinton—									
1912	**5,000**	or	.....	**5,000**	**5,000**	or	.....	**5,000**	.....
Corning—									
1912	.....	.....	.....	**4,160**	**140**	.....	.....	.....	.....
Council Bluffs—									
1911	.....	.....	.....	20,114	.....	.....	.....	.....	.....
1912	.....	.....	.....	**20,100**	.....	.....	.....	.....	.....
Creston—									
1912	.....	.....	**21,120**	.....	**1,000**	.....	.....	.....	.....
Davenport—									
1912	.....	.....	.....	**20,000**	.....	.....	.....	.....	.....
Des Moines—									
1912	**5,000**	.....	.....	.....	.....	.....	.....	.....	.....
Dubuque—									
1911	.....	.....	4,200	1,400	100	12,400	.....	.....	.....
Eldora—									
1911	.....	.....	.....	.....	3,200	.....	.....	.....	.....
Fairfield—									
1912	.....	.....	.....	**4,500**	.....	.....	.....	**1,600**	.....
Ft. Dodge—									
1911	3,600	.....	.....	.....	5,400	.....	.....	1,350	.....
1912	.....	.....	.....	.....	**4,500**	.....	.....	.....	.....
Harlan—									
1911	.....	.....	.....	.....	4,200	.....	.....	.....	.....
1912	.....	.....	.....	.....	6,000	.....	.....	.....	.....
Independence—									
1911	.....	.....	.....	5,640	.....	.....	.....	.....	.....
1912	.....	.....	.....	**720**	.....	.....	.....	.....	.....
Iowa City—									
1911	.....	6,000	.....	.....	.....	.....	.....	.....	.....
1912	.....	**1,000**	.....	.....	.....	.....	.....	.....	.....
Iowa Falls—									
1912	.....	.....	.....	.....	**10,500**	.....	.....	.....	.....
Knoxville—									
1911	.....	.....	.....	.....	3,000	.....	.....	.....	.....
Lake City—									
1911	.....	.....	.....	.....	.....	.....	.....	.....	300
1912	.....	.....	.....	.....	.....	.....	.....	.....	**300**
Maquoketa—									
1911	.....	.....	.....	.....	.....	.....	.....	870	.....

City	Asphalt	Bitulithic	Bituminous	Brick	Concrete	Macadam	Granite	Wood	Others
Manchester—									
1911		2,400			250				
1912		**3,000**							
Marshalltown—									
1911					2,100				
1912					**18,480**				
Mason City—									
1911				3,600	12,000			100	
1912					**15,000**				
Muscatine—									
1911		5,280							
1912				**6,600**	**3,000**	**1,000**			
Newton—									
1912					**5,280**				
Oelwein—									
1912		**9,000**			**4,200**				
Ottumwa—									
1911				960					
1912				**9,000**				**840**	
Pella—									
1911				7,920					
Red Oak—									
1911									9,000
Sheldon—									
1912			**15,000**	or	**15,000**				
Shenandoah—									
1911			13,000						
Sioux City—									
1911				2,500	21,000				
1912					**40,000**				
Villisca—									
1911				5,100					
Waterloo—									
1911	20,000					1,500		540	
1912	**15,000**				**2,700**				
Webster City—									
1911				12,000					
1912				**14,000**					
Winterset—									
1911	2,100								
1912									**10,000**
				KANSAS.					
Abilene—									
1912				**15,000**					
Arkansas City—									
1911	2,640			10,600	1,220			5,000	
Atchison									
1911				5,280					
1912				**900**	**3,000**				
Clay Center—									
1911				975					
Coffeyville—									
1911				4,064					
1912				**13,926**					
Eldorado—									
1912					**528**	**240**			
Emporia—									
1911	10,560			10,200					
1912									**11,880**
Ft. Scott—									
1911				15,000		1,880			
1912				**15,000**		**8,400**			
Great Bend—									
1912				**7,500**	**3,000**				**45,000**
Hutchinson—									
1911				15,000				1,200	
Independence—									
1911				11,616					
1912				**5,280**					
Kansas City—									
1911	10,085	12,408		14,045	8,131	2,006			
Lawrence—									
1911				18,800					
1912				**6,000**					
Leavenworth—									
1911			5,770	5,000					
1912				**10,560**					
Manhattan—									
1911			17,400	3,600					
1912			**12,000**	**3,600**					
McPherson—									
1911				2,992					
1912				**2,231**					
Newton—									
1911				2,000					
Olathe—									
1912				**4,000**	**4,000**				

City	Asphalt	Bitulithic	Bituminous	Brick	Concrete	Macadam	Granite	Wood	Others
Osawatomie—									
1911	.....	.....	.....	.....	.....	.....	.....	.....	10,560
Ottawa—									
1911	.....	.....	8,060	5,502	459	3,090	.....	.....	.....
Parsons—									
1912	.....	.....	.....	**11,000**	.....	**2,800**	.....	.....	.....
Pittsburg—									
1911	.....	.....	.....	3,382	.....	.....	.....	.....	.....
1912	.....	.....	.....	**9,300**	.....	.....	.....	.....	**3,900**
Rosedale—									
1911	.....	7,000	.....	.....	.....	.....	.....	.....	.....
Salina—									
1911	.....	.....	12,830	.....	1,400	.....	.....	.....	.....
1912	.....	.....	**3,280**	.....	.....	.....	.....	.....	.....
Topeka—									
1911	.....	.....	.....	16,000	.....	.....	.....	.....	.....
1912	.....	.....	**9,900**	**22,500**	.....	.....	.....	.....	.....
Wichita—									
1911	8,200	9,500	1,300	65,800	21,000	.....	.....	190	.....
1912	**2,640**	.....	.....	**21,120**	**9,240**	.....	.....	**2,640**	.....
				KENTUCKY.					
Cattlettsburg—									
1911	.....	.....	.....	7,200	.....	.....	.....	.....	.....
Dayton—									
1911	.....	.....	.....	.....	.....	3,000	.....	.....	.....
1912	.....	.....	.....	**3,200**	.....	**3,500**	.....	.....	.....
Lexington—									
1911	12,300	.....	.....	15,000	.....	7,000	.....	.....	.....
1912	**8,500**	.....	**2,000**	**2,100**	.....	**1,500**	.....	.....	.....
Louisville—									
1911	28,596	.....	.....	17,796	.....	.....	.....	.....	300
1912	**30,000**	.....	.....	**18,000**	.....	.....	.....	.....	.....
Ludlow—									
1911	.....	.....	.....	400	.....	.....	.....	.....	.....
1912	.....	.....	**1,000**	**4,000**	.....	.....	.....	.....	.....
Mt. Sterling—									
1912	.....	.....	.....	**10,000**	.....	.....	.....	.....	.....
Owensboro—									
1911	.....	.....	3,400	.....	.....	1,300	.....	.....	.....
1912	.....	.....	**4,500**	.....	.....	.....	.....	.....	.....
Paducah—									
1911	.....	.....	12,600	22,000	.....	.....	.....	.....	.....
Pineville—									
1911	.....	.....	.....	.....	6,000	.....	.....	.....	.....
1912	.....	.....	.....	.....	**6,000**	.....	.....	.....	.....
				LOUISIANA.					
Alexandria—									
1911	.....	1,700	.....	.....	.....	.....	.....	.....	.....
1912	.....	.....	.....	.....	.....	.....	.....	.....	**1,650**
Crowley—									
1912	.....	.....	.....	**3,500**	.....	.....	.....	.....	.....
Lake Charles—									
1912	**12,000**	.....	.....	**1,000**	.....	.....	.....	**18,000**	.....
New Orleans—									
1911	14,000	5,800	1,600	.....	3,500	.....	.....	3,000	560
Shreveport—									
1911	.....	3,800	.....	.....	.....	.....	.....	15,300	.....
				MAINE.					
Lewiston—									
1911	.....	.....	3,780	.....	.....	.....	.....	.....	.....
Portland—									
1911	.....	.....	.....	.....	4,800	.....	380	.....	.....
Rockland—									
1911	.....	.....	.....	.....	.....	2,700	2,085	.....	270
1912	.....	.....	**750**	.....	.....	.....	**750**	.....	**2,700**
Skowhegan—									
1911	.....	.....	.....	.....	.....	3,500	.....	.....	.....
1912	.....	.....	.....	.....	.....	**3,000**	.....	.....	.....
				MARYLAND.					
Annapolis—									
1911	.....	.....	1,100	.....	.....	.....	.....	.....	.....
1912	.....	.....	**900**	.....	.....	.....	.....	.....	.....
Baltimore—									
1911	.....	.....	.....	.....	.....	.....	.....	550	.....
1912	**52,000**	.....	.....	.....	.....	.....	.....	.....	**28,000**
Brunswick—									
1912	.....	.....	.....	.....	.....	**6,600**	.....	.....	.....
Cambridge—									
1911	.....	.....	.....	6,000	.....	.....	.....	.....	.....
1912	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cumberland—									
1911	.....	.....	.....	3,000	.....	.....	.....	.....	.....
1912	.....	.....	.....	**6,300**	.....	.....	.....	.....	.....
Westminster—									
1911	.....	.....	3,500	.....	.....	.....	.....	.....	240
1912	**50**	.....	.....	.....	**100**	**700**	.....	.....	.....

City	Asphalt	Bitulithic	Bituminous	Brick	Concrete	Macadam	Granite	Wood	Others
MASSACHUSETTS.									
Agawam—									
1911	.....	.....	.....	.....	.....	2,500	.....	.....	.....
1912	.....	.....	.....	.....	.....	**4,000**	.....	.....	.....
Attleboro—									
1911	.....	.....	.....	.....	.....	5,640	.....	.....	10,000
Cambridge—									
1911	.....	6,800	.....	.....	.....	.....	.....	.....	.....
East Hampton—									
1911	.....	.....	.....	.....	.....	2,500	.....	.....	.....
1912	.....	.....	.....	.....	.....	**1,000**	.....	.....	.....
Everett—									
1911	.....	.....	3,180	.....	.....	.....	2,900	.....	.....
Greenfield—									
1911	.....	.....	.....	.....	.....	1,170	.....	.....	4,000
Haverhill—									
1911	.....	.....	11,100	.....	2,300	4,400	1,400	.....	600
Lawrence—									
1911	3,200	.....	.....	.....	.....	2,400	3,185	.....	.....
Lowell—									
1911	.....	.....	.....	.....	.....	6,600	7,000	.....	2,700
1912	.....	.....	.....	.....	.....	**6,600**	**7,500**	.....	**2,700**
Lynn—									
1911	.....	.....	.....	.....	6,400	30,000	2,000	.....	.....
1912	.....	.....	.....	.....	**6,000**	**30,000**	**2,250**	.....	.....
Medford—							..		
1911	.....	.....	935	.....	.....	2,000	.....	.....	.....
New Bedford—									
1911	.....	9,000	.....	.....	.....	23,430	5,900	.....	.....
1912	.....	**7,500**	.....	.....	.....	**24,000**	**3,000**	.....	.....
North Attleboro—									
1911	.....	.....	2,500	.....	.....	60,000	.....	.....	.....
1912	.....	.....	**3,000**	.....	.....	**10,560**	.....	.....	.....
Quincy—									
1911	.....	.....	.....	.....	.....	.....	.....	300	.....
Somerville—									
1911	.....	.....	6,300	2,200	.....	.....	1,100	.....	.....
1912	.....	.....	.....	.....	.....	.....	.....	.....	**10,000**
Southbridge—									
1911	.....	.....	.....	3,000	.....	1,200	.....	.....	.....
1912	.....	.....	.....	**300**	.....	**1,950**	.....	.....	.....
Springfield—									
1911	.....	2,871	.....	.....	.....	21,200	.....	1,312	2,100
1912	.....	.....	.....	.....	.....	.....	**900**	.....	.....
Westfield—									
1911	.....	.....	1,663	.....	.....	1,644	2,659	.....	.....
Worcester—									
1911	.....	.....	3,000	200	4,300	25,700	12,900	.....	1,620
MICHIGAN.									
Albion—									
1911	.....	.....	6,844	3,960	.....	.....	.....	.....	.....
1912	.....	.....	**5,280**	.....	.....	.....	.....	.....	.....
Allegan—									
1911	.....	.....	.....	5,280	.....	.....	.....	.....	.....
1912	.....	.....	.....	**4,000**	.....	.....	.....	.....	.....
Alpena—									
1911	.....	.....	.....	.....	3,900	.....	.....	.....	.....
1912	.....	.....	.....	.....	3,600	.....	.....	.....	.....
Ann Arbor—									
1911	.....	.....	19,227	.....	.....	.....	.....	.....	.....
1912	.....	.....	**10,000**	.....	.....	.....	.....	.....	.....
Battle Creek—									
1911	.....	.....	.....	4,200	.....	.....	.....	.....	.....
1912	.....	.....	.....	**6,600**	.....	.....	.....	.....	.....
Benton Harbor—									
1911	.....	.....	.....	1,000	.....	360	.....	.....	.....
Bessemer—									
1911	.....	.....	.....	.....	.....	6,720	.....	.....	.....
1912	.....	.....	.....	.....	.....	13,200	.....	.....	.....
Cadillac—									
1911	.....	.....	.....	.....	.....	6,330	.....	.....	.....
1912	.....	.....	.....	.....	.....	**8,450**	.....	.....	.....
Cheboygan—									
1911	.....	.....	1,320	.....	.....	900	.....	.....	.....
1912	.....	.....	**900**	.....	.....	.....	.....	.....	.....
Detroit—									
1911	60,900	.....	.....	3,000	1,000	.....	.....	11,900	.....
1912	**5,280**	.....	.....	**3,000**	.....	.....	.....	**600**	.....
Dowagiac—									
1911	.....	.....	.....	.....	3,000	.....	.....	.....	.....
1912	.....	.....	.....	.....	**2,500**	.....	.....	.....	.....
Escanaba—									
1911	.....	.....	800	.....	3,600	.....	.....	.....	.....
1912	.....	.....	.....	.....	**6,000**	**300**	.....	.....	.....
Flint—									
1911	.....	.....	.....	1,700	.....	.....	.....	.....	.....
1912	**5,000**	.....	.....	.....	.....	.....	.....	.....	.....

City	Asphalt	Bitulithic	Bituminous	Brick	Concrete	Macadam	Granite	Wood	Others
Grand Ledge—									
1911	.....	.....	.....	750	900	.....	.....	.....	.....
1912	.....	.....	.....	.....	.....	.....	.....	.....	**480**
Grand Rapids—									
1911	.....	.....	3,200	15,900	360	.....	.....	.....	14,400
Gladwin—									
1911	.....	.....	.....	.....	.....	3,000	.....	.....	.....
Greenville—									
1911	.....	.....	.....	4,000	.....	.....	.....	.....	.....
Hastings—									
1912	.....	.....	.....	**5,000**	.....	.....	.....	.....	.....
Hillsdale—									
1911	.....	.....	.....	3,300	.....	.....	.....	.....	.....
1912	.....	.....	**3,000**	.....	.....	.....	.....	.....	.....
Holland—									
1911	.....	.....	7,500	.....	.....	.....	.....	.....	.....
1912	.....	.....	**6,600**	.....	.....	.....	.....	.....	.....
Jackson—									
1911	.....	.....	.....	2,800	3,200	.....	.....	.....	.....
1912	.....	.....	.....	**3,000**	**3,000**	.....	.....	.....	.....
Kalamazoo—									
1911	.....	.....	.....	3,000	.....	.....	.....	.....	.....
1912	.....	.....	**12,000**	**4,500**	.....	**12,000**	.....	.....	.....
Lansing—									
1911	.....	.....	.....	.....	3,000	.....	.....	.....	.....
1912	.....	.....	.....	.....	**18,000**	.....	.....	.....	.....
Lapeer—									
1911	.....	.....	.....	.....	.....	2,500	.....	.....	.....
1912	.....	.....	.....	.....	.....	**4,000**	.....	.....	.....
Menominee—									
1912	.....	.....	.....	.....	**216**	**1,890**	.....	.....	.....
Milan—									
1912	.....	.....	.....	**5,000**	.....	.....	.....	.....	.....
Monroe—									
1911	.....	.....	.....	.....	5,000	.....	.....	.....	.....
1912	.....	.....	.....	.....	**15,600**	.....	.....	.....	.....
Mt. Clemens—									
1911	700	.....	.....	400	.....	.....	.....	.....	.....
1912	**3,000**	.....	.....	**300**	.....	.....	.....	.....	.....
Norway—									
1911	.....	.....	2,000	.....	.....	.....	.....	.....	.....
Owosso—									
1911	.....	.....	.....	420	.....	225	.....	.....	.....
1912	.....	.....	.....	**1,950**	**750**	**2,880**	.....	.....	.....
Pontiac—									
1911	2,640	.....	.....	1,500	.....	.....	.....	.....	.....
1912	.....	.....	.....	.....	.....	**5,280**	.....	.....	.....
Port Huron—									
1911	.....	.....	1,300	1,000	.....	.....	.....	.....	.....
1912	.....	.....	**6,500**	.....	.....	.....	.....	.....	.....
Saginaw—									
1911	14,500	.....	.....	.....	.....	.....	.....	.....	.....
St. Johns—									
1911	.....	.....	.....	1,350	365	.....	.....	.....	.....
1912	.....	.....	.....	**280**	**3,785**	.....	.....	.....	.....
St. Joseph—									
1911	.....	.....	.....	2,294	.....	.....	1,800	.....	.....
Sault Ste Marie—									
1911	.....	.....	1,000	.....	.....	.....	.....	.....	.....
1912	.....	.....	**8,000**	.....	.....	.....	.....	.....	.....
Whitehall—									
1911	.....	.....	.....	.....	.....	3,960	.....	.....	.....
Wyandotte—									
1911	.....	.....	.....	3,000	.....	.....	.....	.....	.....
				MINNESOTA.					
Albert Lea—									
1911	.....	.....	.....	.....	.....	.....	.....	9,500	.....
Bemidji—									
1911	.....	.....	.....	.....	5,846	.....	.....	.....	.....
1912	.....	.....	.....	.....	**2,338**	.....	.....	.....	.....
Cloquet—									
1912	.....	.....	.....	.....	.....	**3,000**	.....	.....	.....
Crookston—									
1911	5,600	.....	6,480	.....	.....	6,300	600	.....	.....
1912	**4,300**	.....	**1,960**	.....	.....	.....	.....	.....	.....
Faribault—									
1912	.....	.....	**11,500**	.....	.....	.....	.....	.....	**18,300**
Mankato—									
1911	5,600	.....	1,890	203	.....	4,350	.....	6,320	31,680
1912	.....	.....	**some**	**some**	.....	.....	.....	**some**	.....
Minneapolis—									
1911	.....	.....	8,700	5,280	.....	.....	4,500	52,800	.....
1912	.....	.....	.....	.....	.....	.....	.....	**10,000**	.....
New Ulm—									
1911	.....	.....	.....	.....	.....	.....	.....	.....	2,640
Red Wing—									
1911	.....	.....	.....	.....	.....	2,820	.....	.....	.....

City	Asphalt	Bitulithic	Bituminous	Brick	Concrete	Macadam	Granite	Wood	Others
Rochester—									
1911	.....	.....	.....	.....	.....	.....	.....	2,200	.....
St. Cloud—									
1911	.....	.....	1,500	.....	.....	.....	.....	.....	.....
St. Paul—									
1911	.....	.....	.....	1,500	.....	.....	.....	.....	.....
1912	.....	.....	.....	**15,000**	.....	.....	.....	.....	.....
Two Harbors—									
1911	.....	.....	.....	.....	.....	1,036	.....	.....	.....
Virginia—									
1911	.....	9,600	.....	.....	.....	.....	.....	4,400	.....
Winona—									
1911	.....	.....	.....	3,300	.....	.....	.....	.....	.....
1912	.....	.....	.....	**1,600**	.....	.....	.....	.....	.....
MISSISSIPPI.									
Columbus—									
1912	.....	.....	**36,000**	.....	.....	.....	.....	.....	.....
Grenada—									
1912	.....	.....	.....	.....	.....	.....	.....	**18,000**	.....
Jackson—									
1911	6,500	5,100	1,500	.....	.....	.....	.....	8,300	.....
1912	.....	.....	.....	**6,600**	.....	.....	.....	.....	.....
Meridian—									
1912	.....	**1,500**	.....	.....	.....	.....	.....	.....	.....
Port Gibson—									
1912	.....	.....	.....	.....	.....	.....	.....	.....	**3,300**
Tupelo—									
1911	.....	.....	.....	.....	.....	.....	.....	.....	5,200
1912	.....	.....	**15,000**	.....	.....	.....	.....	.....	.....
Vicksburg—									
1911	.....	.....	.....	9,000	.....	.....	.....	.....	.....
1912	.....	.....	.....	**6,600**	.....	.....	.....	.....	.....
West Point—									
1912	.....	.....	.....	.....	.....	**3,300**	.....	.....	.....
MISSOURI.									
Aurora—									
1911	.....	.....	.....	.....	.....	.....	.....	.....	200
Bethany—									
1911	.....	.....	.....	.....	465	.....	.....	.....	.....
1912	.....	.....	.....	.....	**5,280**	.....	.....	.....	.....
Boonville—									
1912	.....	.....	.....	.....	.....	.....	.....	.....	**some**
Brookfield—									
1911	.....	.....	.....	15,000	.....	.....	.....	.....	.....
1912	.....	.....	.....	**12,000**	.....	.....	.....	.....	.....
Butler—									
1912	.....	.....	.....	**5,280**	.....	.....	.....	.....	.....
Cape Girardeau—									
1911	.....	.....	.....	1,400	.....	.....	.....	.....	.....
1912	.....	.....	.....	.....	.....	.....	.....	**930**	.....
Carrollton—									
1911	.....	.....	.....	18,000	.....	.....	.....	.....	.....
1912	.....	.....	.....	**9,000**	.....	.....	.....	.....	.....
Caruthersville—									
1911	.....	.....	.....	.....	.....	.....	.....	.....	1,500
1912	.....	.....	.....	.....	.....	.....	.....	.....	**1,500**
Clinton—									
1911	.....	some	.....	.....	.....	.....	.....	.....	.....
Columbia—									
1911	.....	.....	.....	10,000	.....	.....	.....	.....	.....
1912	.....	.....	.....	**9,600**	.....	.....	.....	.....	.....
DeSoto—									
1912	.....	.....	.....	.....	.....	**4,000**	.....	.....	.....
Eldorado Springs—									
1911	.....	.....	.....	1,500	.....	.....	.....	.....	.....
1912	.....	.....	.....	.....	**3,700**	.....	.....	.....	.....
Fulton—									
1911	.....	.....	.....	2,700	.....	5,000	.....	.....	.....
1912	.....	.....	**660**	**300**	.....	.....	.....	.....	.....
Hannibal—									
1911	.....	.....	.....	15,000	.....	52,800	.....	.....	10,000
1912	.....	.....	**9,000**	**12,000**	**3,000**	.....	.....	.....	.....
Independence—									
1911	.....	2,400	.....	.....	9,000	.....	.....	.....	.....
Jerseyville—									
1912	.....	.....	.....	.....	.....	.....	.....	.....	**7,000**
Joplin—									
1911	.....	.....	.....	.....	.....	.....	.....	6,900	.....
Kansas City—									
1911	31,960	.....	2,000	7,000	35,278	.....	4,912	6,112	67,520
1912	**34,000**	.....	.....	**8,000**	**45,000**	.....	**5,000**	**8,400**	**68,000**
Kirksville—									
1911	.....	.....	.....	1,500	600	.....	.....	.....	.....
1912	.....	.....	.....	**3,500**	**1,800**	.....	.....	.....	.....
Lexington—									
1912	.....	.....	**5,000**	.....	.....	.....	.....	.....	.....

City	Asphalt	Bitulithic	Bituminous	Brick	Concrete	Macadam	Granite	Wood	Others
Liberty—									
1911	.....	.....	.....	1,000	5,000	.....	.....	.....	.....
1912	.....	.....	.....	.....	**5,000**	.....	.....	.....	.....
Libertyville—									
1911	.....	.....	.....	9,000	.....	.....	.....	.....	.....
Macon—									
1911	.....	.....	.....	27,000	.....	.....	.....	.....	.....
Mexico—									
1911	.....	.....	.....	100	.....	.....	.....	.....	.....
1912	.....	.....	.....	**3,000**	.....	.....	.....	.....	.....
Moberly—									
1911	.....	.....	.....	1,800	.....	.....	.....	.....	.....
1912	.....	.....	.....	**6,300**	.....	.....	.....	.....	.....
Nevada—									
1912	.....	.....	**3,000**	**3,000**	**6,000**	.....	.....	.....	.....
Oregon—									
1911	.....	.....	.....	.....	.....	.....	.....	.....	2,640
Poplar Bluff—									
1912	.....	.....	.....	.....	.....	.....	**9,000**	.....	.....
St. Charles—									
1911	.....	.....	.....	.....	.....	750	.....	.....	600
1912	.....	.....	**2,700**	.....	**5,400**	.....	.....	.....	.....
St. Joseph—									
1912	**2,500**	.....	**5,000**	.....	**7,500**	.....	.....	.....	.....
St. Louis—									
1911	.....	22,100	.....	.....	.....	.....	.....	12,900	.....
Sedalia—									
1911	.....	.....	.....	5,280	.....	.....	.....	.....	.....
1912	.....	.....	.....	**13,200**	.....	.....	.....	.....	.....
Springfield—									
1911	.....	.....	.....	.....	.....	.....	.....	1,800	.....
Tarkio—									
1911	.....	.....	.....	.....	2,400	.....	.....	.....	.....
Webb City—									
1911	.....	.....	9,123	1,758	.....	.....	.....	.....	.....
				MONTANA.					
Billings—									
1911	.....	.....	.....	.....	600	.....	.....	.....	.....
1912	.....	.....	.....	**6,000**	**1,300**	.....	.....	**19,000**	.....
Bozeman—									
1911	.....	.....	.....	.....	8,100	.....	.....	.....	.....
1912	.....	.....	.....	.....	**6,000**	.....	.....	.....	.....
Butte—									
1911	.....	.....	.....	3,000	.....	2,400	.....	.....	.....
Great Falls—									
1911	.....	.....	.....	.....	.....	.....	.....	540	.....
1912	.....	.....	.....	.....	**12,800**	.....	.....	.....	.....
Helena—									
1911	.....	.....	.....	6,900	.....	.....	.....	9,600	.....
1912	.....	.....	.....	**4,500**	.....	.....	.....	.....	.....
Kalispel—									
1911	.....	2,500	7,200	.....	.....	10,560	.....	.....	45,000
Missoula—									
1911	.....	480	.....	.....	.....	3,600	.....	.....	12,300
1912	.....	.....	.....	**7,200**	.....	.....	.....	.....	.....
				NEBRASKA.					
Chadron—									
1911	.....	.....	.....	.....	.....	.....	.....	.....	3,500
Fremont—									
1911	.....	.....	.....	2,640	.....	.....	.....	.....	.....
1912	.....	.....	.....	**5,280**	**600**	.....	.....	.....	.....
Hastings—									
1911	.....	.....	.....	15,840	.....	.....	.....	.....	.....
Lincoln—									
1911	9,645	175	.....	11,100	650	785	.....	.....	.....
1912	**9,000**	**3,000**	.....	**3,000**	.....	.....	.....	.....	.....
Norfolk—									
1911	.....	.....	.....	2,900	.....	.....	.....	.....	.....
1912	.....	.....	**13,200**	.....	.....	.....	.....	.....	.....
Omaha—									
1911	18,860	.....	9,900	20,328	1,350	.....	3,900	4,000	.....
South Omaha—									
1911	.....	.....	12,668	12,735	4,924	.....	.....	.....	.....
1912	.....	.....	**11,440**	**22,880**	**3,150**	.....	.....	.....	.....
University Place—									
1911	.....	.....	.....	1,600	.....	.....	.....	.....	.....
York—									
1911	.....	.....	.....	15,840	.....	.....	.....	.....	.....
				NEW HAMPSHIRE.					
Concord—									
1911	.....	.....	2,000	.....	.....	2,000	.....	.....	.....
1912	.....	.....	**Some**	.....	.....	**Some**	.....	.....	.....
Dover—									
1911	.....	720	.....	.....	.....	11,880	480	.....	18,500
1912	.....	.....	.....	.....	.....	**10,560**	**3,600**	.....	**21,120**

City	Asphalt	Bitulithic	Bituminous	Brick	Concrete	Macadam	Granite	Wood	Others
Keene—									
1911			1,100			1,200	900		
Laconia—									
1911			6,600						
1912			**6,000**						
Littleton—									
1911					200				3,600
NEW JERSEY.									
Atlantic City—									
1911		6,600							
Bayonne—									
1911	8,200			3,800					
Beach Haven—									
1911									50,000
Bloomfield—									
1911						143,100			
1912		**2,640**				**15,280**	**15,840**		
Burlington—									
1912		**3,960**							
Camden—									
1911	6,900			1,300		990	120		
Dover—									
1911				1,500					
Elizabeth—									
1911			1,566	5,090			824		
1912			**1,000**	**9,777**			**6,535**		
Glen Ridge—									
1911						1,651			
1912						**901**			
Harrison—									
1911		900							
Hoboken—									
1911								4,500	
Jersey City—									
1911	7,498		2,700	13,464		9,018	845	1,320	
1912	750		**1,000**	**1,600**			3,900		
Kearney—									
1911		5,100							
Montclair—									
1911			3,600						
1912						79,200			
Newark—									
1911	1,768	28,882		30,801			21,410		
1912		35,000		22,000			30,000		
Ocean City—									
1911									5,000
1912									**6,000**
Paterson—								4,500	
1911									
Perth Amboy—									
1911		3,300							
Phillipsburg—									
1912						**300**			
Plainfield—									
1911						5,000			
Rahway—									
1911				15,000					
Rutherford—									
1911			2,100			8,700			
1912			**7,920**	**9,000**		**7,920**			
South Amboy—									
1912		**3,750**							
Summit—									
1911			840	1,320		2,000			
1912				**7,350**		**3,000**			
Trenton—									
1911	6,836		14,516	740	847	1,478			
1912	1,050		**10,000**	**3,000**	**550**				
Westfield—									
1911			7,300			13,500			
1912			**3,000**			**4,500**			
West New York—									
1911	1,500			1,900					
1912							**6,000**		
NEW MEXICO.									
Albuquerque—									
1912		**7,500**							
Las Vegas—									
1912									**some**
NEW YORK.									
Albany—									
1911				10,560			1,100		
1912			**900**	**12,000**	**1,200**		**1,500**		
Amsterdam—									
1911				2,100					

City	Asphalt	Bitulithic	Bituminous	Brick	Concrete	Macadam	Granite	Wood	Others
Auburn—									
1911				4,335		29,215	975		
1912	**2,800**			**6,565**		**30,000**	**600**		
Binghamton—									
1911				4,604					
1912			**4,500**	**4,342**	**507**	**5,000**		**2,208**	
Buffalo—									
1911	31,877			11,418			6,973		
1912	**15,000**				**5,000**				
Canajoharie—									
1911				1,260					
Canastota—									
1912				**5,400**					
Carthage—									
1911			330			330			
1912			**9,900**	**2,250**					
Corning—									
1911				2,960					
Cortland—									
1912	**3,000**		**1,800**						
Dobbs Ferry—									
1911	540		31,680	4,500		5,280			10,560
1912				**6,000**		**6,000**			
Dunkirk—									
1911	6,300			2,350					
1912	**6,000**			**7,000**					
Elmira—									
1911				900					
1912				**5,400**					
Fulton—									
1912			**5,100**	**9,300**					
Geneseo—									
1911			2,250						
1912				**180**		**8,660**	**900**		
Herkimer—									
1911		2,000	5,500	1,100					
1912		**4,300**							
Hoosick Falls—									
1911			3,500						
Hornell—									
1911			700	330					
Hudson—									
1911			1,000	4,200		1,500			
1912			**1,500**	**2,700**	**500**	**180**			
Hudson Falls—									
1911				420					
Ithaca—									
1911			1,320	79,200		10,560	3,960		10,560
Jamestown—									
1911				15,800					
1912				**15,000**					
Kingston—									
1911			2,400	4,300		6,000			
1912			**3,000**	**1,500**		**6,000**	**1,500**		
Larchmont—									
1912						**15,840**			
Lestershire—									
1912				4,800					
Little Falls—									
1911		1,800	900			1,000	300		
1912			**5,000**	**900**					**2,500**
Little Valley—									
1912				**5,000**					
Lockport—									
1911								600	
Lowville—									
1912			**5,280**						
Middletown—									
1911			3,000	2,700		10,560			10,560
1912				**3,000**					
Moravia—									
1912				**2,000**					
Newark—									
1911				3,000					
NEW YORK CITY—									
Bronx—									
1911	58,000		2,700			1,000	12,000	2,000	
1912						329,000			
Brooklyn—									
1911	128,000					210	2,700		
1912	**266,000**	**6,000**				**6,000**	**58,000**	**17,000**	
Manhattan—									
1911	127,000						68,000	31,000	
1912	**187,000**						**90,000**	**40,500**	*

*Appropriation for repairing with sheet asphalt, granite and wood block is $3,500,000 for 1912.

Richmond—									
1911			41,000	18,000	210		4,000	7,000	1,500

City	Asphalt	Bitulithic	Bituminous	Brick	Concrete	Macadam	Granite	Wood	Others
Niagara Falls—									
1911	4,900	.....	.....	2,500	5,500	.....	.....	.....	.....
1912	.....	.....	.....	.....	.....	.....	.....	.....	**12,000**
N. Tonawanda—									
1911	.....	.....	.....	.....	.....	3,000	.....	.....	.....
1912	.....	.....	.....	.....	.....	.....	.....	.....	**4,000**
Norwich—									
1911	.....	.....	900	5,700	.....	.....	.....	.....	.....
1912	.....	.....	.....	**3,800**	.....	.....	.....	.....	.....
Ogdensburg—									
1912	.....	.....	.....	**12,000**	.....	.....	.....	.....	.....
Olean—									
1911	.....	.....	.....	5,000	.....	.....	.....	.....	.....
Oneida—									
1911	.....	.....	.....	1,600	.....	.....	.....	.....	.....
Penn Yan—									
1912	.....	.....	.....	**2,500**	.....	.....	.....	.....	.....
Plattsburg—									
1911	2,000	.....	.....	1,400	.....	6,920	.....	.....	.....
1912	.....	.....	**10,000**	.....	**3,000**	.....	.....	.....	.....
Poughkeepsie—									
1911	.....	.....	800	6,700	.....	5,100	.....	600	.....
1912	.....	.....	.....	**7,900**	.....	.....	.....	.....	.....
Rochester—									
1911	29,700	.....	4,800	37,500	.....	.....	900	400	.....
Salamanca—									
1911	.....	.....	.....	800	.....	.....	.....	.....	.....
1912	.....	.....	.....	**3,300**	.....	.....	.....	.....	.....
Schenectady—									
1911	18,000	.....	3,000	500	.....	.....	.....	.....	.....
Solvay—									
1911	.....	.....	.....	.....	.....	5,000	.....	.....	.....
Syracuse—									
1911	4,963	.....	.....	2,057	.....	2,587	.....	.....	.....
1912	.....	.....	.....	.....	.....	.....	.....	.....	**26,400**
Troy—									
1911	.....	1,300	.....	.....	.....	.....	.....	.....	.....
Utica—									
1911	7,000	1,000	.....	5,200	.....	.....	3,900	.....	.....
1912	**6,000**	**3,000**	.....	**3,000**	.....	.....	.....	.....	.....
Warsaw—									
1912	.....	.....	.....	**14,520**	.....	.....	.....	.....	.....
Watertown—									
1911	.....	.....	1,500	900	.....	7,500	.....	.....	.....
1912	.....	.....	**2,700**	**3,600**	**330**	**7,500**	.....	.....	.....
White Plains—									
1911	.....	.....	3,240	.....	.....	.....	.....	.....	.....
1912	.....	.....	**900**	**300**	**150**	.....	.....	.....	.....
Whitesboro—									
1911	.....	2,100	.....	.....	.....	.....	.....	.....	.....

NORTH CAROLINA.

Asheville—									
1911	.....	2,700	.....	.....	.....	.....	.....	.....	.....
Burlington—									sand clay
1911	.....	.....	.....	.....	.....	.....	.....	.....	52,800
Greenville—									sand clay
1912	.....	.....	.....	.....	.....	.....	.....	.....	**15,800**
Goldsboro—									
1911	.....	.....	.....	.....	.....	.....	.....	.....	1,500
1912	.....	.....	**3,000**	.....	.....	.....	.....	.....	.....
Greensboro—									
1911	.....	.....	390	.....	.....	.....	.....	.....	.....
1912	.....	.....	**4,500**	.....	.....	**1,400**	.....	.....	.....
Monroe—									
1911	.....	.....	6,000	.....	.....	6,000	.....	.....	1,500
1912	.....	.....	**12,000**	.....	.....	.....	.....	.....	**12,000**
Raleigh—									gravel
1912	.....	.....	.....	.....	.....	.....	.....	.....	**45,000**
Wilson—									
1911	.....	2,000	.....	.....	.....	.....	.....	.....	.....
1912	.....	**2,000**	.....	.....	.....	.....	.....	.....	.....

NORTH DAKOTA.

Fargo—									
1911	.....	.....	.....	.....	.....	.....	.....	1,380	.....
Grand Forks—									granitoid
1911	.....	.....	2,500	.....	666	.....	.....	.....	10,600

OHIO.

Ashland—									
1911	.....	.....	.....	1,800	.....	.....	.....	.....	.....
1912	.....	.....	.....	**2,400**	.....	.....	.....	.....	.....

City	Asphalt	Bitulithic	Bituminous	Brick	Concrete	Macadam	Granite	Wood	Others
Barberton—									
1911	.....	.....	.....	909	.....	.....	.....	.....	.....
1912	.....	.....	.....	**5,400**	.....	.....	.....	.....	.....
Bowling Green—									
1911	.....	.....	.....	.....	.....	4,698	.....	.....	.....
1912	.....	.....	.....	.....	.....	**8,800**	.....	.....	.....
Bryan—									
1912	.....	.....	.....	**12,000**	.....	.....	.....	.....	.....
Bucyrus—									
1911	.....	.....	.....	1,434	.....	.....	.....	.....	.....
Canton—									
1911	.....	.....	.....	15,000	.....	.....	.....	.....	.....
1912	.....	.....	.....	**38,000**	.....	.....	.....	.....	.....
Chillicothe—									
1911	.....	.....	.....	1,650	.....	.....	.....	.....	.....
Circleville—									
1911	.....	.....	.....	12,500	.....	.....	.....	.....	.....
1912	.....	.....	.....	**3,500**	.....	.....	.....	.....	.....
Cincinnati—									
1911	10,500	1,000	10,500	7,500	.....	196,000	12,000	.....	45,000
Cleveland—									
1911	.....	.....	.....	64,000	.....	.....	17,400	.....	1,200
1912	.....	.....	**3,900**	**105,000**	.....	.....	10,100	.....	.....
Columbus—									
1911	12,000	.....	.....	66,000	.....	.....	1,300	.....	1,300
1912	**13,500**	.....	.....	**71,000**	.....	.....	.....	.....	.....
Conneaut—									
1912	.....	.....	.....	**5,280**	.....	.....	.....	.....	.....
Coshocton—									
1911	1,894	.....	.....	120	.....	.....	.....	.....	.....
Dayton—									
1911	8,100	.....	.....	43,500	.....	.....	.....	.....	.....
1912	**5,000**	.....	.....	**50,000**	.....	.....	.....	.....	.....
Fostoria—									
1911	.....	.....	.....	6,300	.....	.....	.....	.....	.....
1912	.....	.....	.....	**10,500**	.....	.....	.....	.....	.....
Galion—									
1911	3,200	.....	.....	3,519	.....	.....	.....	.....	.....
1912	**6,600**	.....	.....	**750**	.....	.....	.....	.....	**6,000**
Greenville—									
1911	.....	.....	.....	2,650	.....	.....	.....	.....	.....
Hamilton—									**gravel**
1911	2,300	.....	1,200	.....	.....	.....	.....	.....	.....
1912	**15,000**	.....	.....	.....	.....	.....	.....	.....	**3,600**
Lancaster—									
1911	.....	.....	.....	6,000	.....	.....	.....	.....	.....
1912	.....	.....	.....	**9,000**	.....	.....	.....	.....	.....
Lorain—									
1911	4,800	.....	2,850	5,400	.....	.....	.....	.....	.....
1912	.....	.....	.....	.....	.....	.....	.....	.....	**15,000**
Marion—									
1911	800	.....	905	1,290	.....	.....	.....	840	.....
1912	**2,900**	.....	**870**	**3,500**	**1,100**	**1,890**	.....	.....	.....
Massillon—									
1911	.....	.....	.....	15,000	.....	.....	.....	.....	.....
1912	.....	.....	.....	**6,800**	.....	.....	.....	.....	**15,000**
Millersburg—									
1911	.....	.....	.....	4,100	.....	.....	.....	.....	.....
1912	.....	.....	.....	**16,000**	.....	.....	.....	.....	.....
Miamisburg—									
1912	.....	.....	.....	.....	.....	**4,500**	.....	.....	.....
Monroeville—									
1911	.....	.....	.....	2,400	.....	.....	.....	.....	.....
Mount Vernon—							..		
1911	.....	.....	.....	900	.....	.....	.....	.....	.....
1912	.....	.....	.....	**4,500**	**4,500**	.....	.....	.....	.....
Mt. Gilead—									
1911	.....	.....	5,000	.....	.....	1,250	.....	.....	.....
Newark—									
1911	.....	.....	.....	.....	.....	600	.....	.....	.....
1912	.....	.....	.....	**9,000**	.....	.....	.....	.....	.....
Newburgh City—									
1912	.....	.....	.....	**7,200**	.....	.....	.....	.....	.....
New Lexington—									
1911	.....	.....	.....	2,395	.....	.....	.....	.....	.....
1912	.....	.....	.....	**1,700**	.....	.....	.....	.....	.....
Pomeroy—									
1911	.....	.....	.....	6,000	.....	.....	.....	.....	.....
1912	.....	.....	.....	**1,800**	.....	.....	.....	.....	.....
Port Clinton—									
1911	.....	.....	.....	900	.....	.....	.....	.....	.....
1912	.....	.....	.....	**2,400**	.....	.....	.....	.....	.....
Piqua—									
1911	.....	.....	.....	4,500	.....	.....	.....	.....	.....
Ravenna—									
1911	.....	.....	.....	3,800	.....	.....	.....	.....	.....
1912	.....	.....	.....	**4,000**	.....	.....	.....	.....	.....

City	Asphalt	Bitulithic	Bituminous	Brick	Concrete	Macadam	Granite	Wood	Others
Sandusky—									
1911	4,000	.....	.....	400	.....	.....	.....	.....	.....
Toledo—									
1911	.....	4,200	.....	.....	.....	.....	.....	.....	.....
Van Wert—									
1911	.....	.....	.....	3,100	.....	3,960	.....	.....	.....
1912	.....	.....	.....	**3,960**	.....	.....	.....	.....	.....
Wapakoneta—									
1911	.....	.....	.....	5,280	.....	.....	.....	.....	.....
Warren—									
1911	18,000	.....	.....	22,500	.....	18,300	15,000	.....	.....
Zanesville—									
1911	.....	.....	.....	5,100	.....	.....	.....	.....	.....
1912	.....	.....	.....	**5,100**	.....	.....	.....	.....	.....
			OKLAHOMA.						
Altus—									
1911	.....	56,000	.....	.....	.....	.....	.....	.....	.....
1912	.....	**49,000**	.....	.....	.....	.....	.....	.....	.....
Alva—									
1911	7,600	.....	3,960	.....	3,960	.....	.....	.....	.....
1912	.....	.....	**2,640**	**1,760**	.....	.....	.....	.....	.....
Bartlesville—									
1911	.....	770	.....	5,180	.....	.....	.....	.....	.....
1912	.....	**8,600**	.....	**3,540**	.....	.....	.....	.....	.....
Chickasha—									
1911	.....	.....	.....	675	.....	.....	.....	.....	.....
Clinton—									
1912	**30,000**	.....	.....	.....	.....	.....	.....	.....	.....
Durant—									
1911	2,700	.....	.....	5,800	.....	.....	.....	.....	.....
1912	**3,300**	.....	.....	.....	.....	.....	.....	.....	.....
Frederick—									
1912	.....	.....	.....	.....	**10,560**	.....	.....	.....	.....
Muskogee—									
1911	60,000	.....	5,100	3,000	.....	3,600	.....	.....	.....
1912	**30,000**	.....	**13,500**	**4,500**	.....	.....	.....	.....	.....
Oklahoma City—									
1911	82,600	.....	.....	2,400	.....	3,000	.....	.....	.....
Sapulpa—									
1912	**10,500**	.....	.....	**6,000**	.....	.....	.....	.....	.....
			OREGON.						
Albany—									
1911	.....	7,500	.....	.....	.....	.....	.....	.....	.....
1912	.....	**22,000**	.....	.....	.....	.....	.....	.....	.....
Ashland—									
1911	.....	30,000	.....	.....	.....	.....	.....	.....	.....
Astoria—									
1911	.....	.....	.....	.....	900	8,400	.....	.....	.....
1912	.....	**4,500**	.....	.....	**900**	**900**	.....	**900**	.....
Grant's Pass—									
1911	.....	3,300	.....	.....	.....	1,500	.....	.....	.....
1912	.....	**5,400**	**4,500**	.....	.....	**6,600**	.....	.....	.....
Hillsboro—									
1911	.....	3,600	.....	.....	.....	.....	.....	.....	.....
La Grande—									
1911	.....	12,000	.....	.....	.....	.....	.....	.....	.....
Oregon City—									
1911	.....	.....	13,500	.....	.....	.....	.....	.....	.....
1912	**7,500**	.....	**3,600**	.....	.....	.....	.....	.....	.....
Portland—									Hassam
1911	161,937	22,869	.....	.....	9,821	8,448	17,741	1,531	117,058
1912	**291,000**	**feet of all kinds.**							
Roseburg—									
1911	18,670	.....	1,873	.....	.....	.....	.....	.....	.....
1912	**10,000**	.....	.....	.....	.....	.....	.....	.....	.....
Salem—									
1911	.....	16,500	12,000	.....	25,500	.....	.....	.....	.....
1912	.....	**16,500**	**12,000**	.....	**25,500**	.....	.....	.....	.....
The Dalles—									
1911	.....	13,200	.....	.....	.....	.....	.....	.....	.....
Twin Falls—									
1911	.....	9,300	.....	.....	.....	.....	.....	.....	.....
Pendleton—									Hard surface
1912	.....	.....	.....	.....	.....	**6,900**	.....	.....	**12,600**
			PENNSYLVANIA.						
Allentown—									
1911	6,000	.....	.....	300	.....	3,000	.....	.....	.....
1912	**12,000**	.....	.....	.....	.....	.....	.....	.....	.....
Altoona—									
1911	.....	5,900	.....	.....	.....	.....	.....	.....	.....
Bethlehem—									
1911	.....	.....	1,000	.....	.....	.....	.....	.....	.....
1912	.....	.....	**1,800**	.....	.....	.....	.....	.....	.....
Bloomsburg—									
1911	.....	.....	.....	360	.....	.....	.....	.....	.....

City	Asphalt	Bitulithic	Bituminous	Brick	Concrete	Macadam	Granite	Wood	Others
1912	.....	.....	.....	**360**	.....	.....	.....	.....	.....
Bradford—									
1911	.....	.....	.....	700	.....	.....	.....	.....	.....
1912	.....	.....	.....	**900**	.....	.....	.....	.....	.....
Carbondale—									
1911	.....	.....	2,250	18,000	.....	.....	.....	.....	.....
1912	.....	.....	.....	**15,000**	.....	.....	.....	.....	.....
Carlisle—									
1911	.....	.....	3,000	400	200	7,000	.....	.....	.....
1912	.....	.....	**1,000**	**2,100**	.....	**3,000**	.....	.....	.....
Catasauqua—									
1911	.....	.....	.....	.....	.....	9,100	.....	.....	.....
Claysville—									
1912	.....	.....	.....	**2,165**	.....	.....	.....	.....	.....
Clearfield—									
1912	.....	.....	**1,200**	**1,200**	.....	**3,600**	.....	.....	.....
Chester—									
1911	.....	.....	.....	.....	.....	.....	.....	12,000	.....
Du Bois—									
1911	.....	.....	.....	2,700	.....	.....	.....	.....	.....
1912	.....	.....	.....	**3,300**	.....	.....	.....	.....	.....
Easton—									
1912	.....	.....	.....	**900**	.....	.....	.....	.....	.....
East Stroudsburg—									
1912	.....	.....	.....	**5,280**	.....	**3,000**	.....	.....	.....
Edwardsville—									
1911	.....	.....	.....	2,100	.....	.....	.....	.....	.....
Erie—									
1911	9,588	.....	.....	1,500	.....	.....	.....	.....	.....
Franklin—									
1911	.....	.....	.....	9,000	.....	.....	.....	.....	.....
1912	.....	.....	.....	**6,000**	.....	.....	.....	.....	.....
Harrisburg—									
1911	50,000	.....	.....	900	.....	.....	.....	.....	.....
1912	**45,000**	.....	.....	.....	.....	.....	.....	.....	.....
Hollidayburg—									
1911	.....	3,600	.....	2,400	.....	.....	.....	.....	.....
1912	.....	.....	.....	**600**	.....	.....	.....	.....	.....
Indiana—									
1911	.....	.....	.....	10,560	.....	.....	.....	.....	.....
1912	.....	.....	.....	**6,000**	.....	.....	.....	.....	.....
Kingston—									
1911	.....	.....	900	5,600	.....	.....	.....	450	.....
1912	.....	.....	.....	**1,500**	.....	.....	.....	.....	.....
Lancaster—									
1911	6,000	.....	6,000	30,000	.....	22,400	9,000	.....	.....
Latrobe—									
1911	.....	.....	.....	2,500	.....	.....	.....	.....	.....
McKeesport—									
1911	.....	.....	.....	5,400	.....	.....	300	.....	.....
1912	.....	.....	.....	**15,000**	.....	.....	.....	.....	.....
Mechanicsburg—									
1911	.....	.....	.....	2,400	.....	3,600	.....	.....	.....
1912	.....	.....	.....	**3,600**	.....	.....	.....	.....	.....
Media—									
1911	.....	.....	110,000	.....	.....	.....	.....	.....	.....
Meadville—									
1911	.....	.....	.....	1,800	.....	.....	.....	.....	.....
Miners' Mills—									
1912	.....	.....	.....	**2,500**	.....	.....	.....	.....	.....
Northumberland—									
1911	.....	.....	.....	900	.....	.....	.....	.....	.....
1912	.....	.....	.....	**1,800**	.....	.....	.....	.....	.....
Philadelphia—									
1911	.....	.....	.....	.....	.....	.....	.....	9,000	.....
Pittsburg—									
1911	6,000	.....	.....	6,600	.....	.....	15,000	.....	.....
Oil City—							Wood, bituminous or brick		
1911	.....	.....	.....	8,398	.....	.....	.....	.....	.....
1912	.....	.....	.....	**2,130**	.....	.....	.....	.....	**8,140**
Punxsutawney—									
1911	.....	.....	.....	2,480	.....	.....	.....	.....	.....
1912	.....	.....	.....	**2,400**	.....	.....	.....	.....	.....
Rankin—							.....	.....	.....
1911	.....	.....	.....	10,500	.....	.....	1,050	.....	.....
1912	.....	.....	.....	**2,100**	.....	.....	.....	.....	.....
Ridgway—									
1911	.....	.....	.....	2,500	.....	.....	.....	.....	.....
Sayre—									
1911	.....	.....	.....	2,000	.....	.....	.....	.....	.....
1912	.....	.....	.....	**1,500**	.....	**3,000**	.....	.....	.....
Scranton—									
1911	17,890	.....	.....	.....	.....	.....	330	.....	.....
1912	**3,380**	.....	.....	.....	.....	.....	.....	.....	.....
S. Bethlehem—									
1911	.....	.....	1,500	.....	.....	.....	.....	.....	.....
1912	.....	**5,400**	**6,600**	.....	.....	.....	.....	.....	.....

City	Asphalt	Bitulithic	Bituminous	Brick	Concrete	Macadam	Granite	Wood	Others
Swissvale—									
1911				3,570					
1912				**15,000**					
Warren—									
1911				3,000					
Westchester—									
1911						7,500			
Wilkes Barre—									
1911	32,222			30,996					
1912	**15,350**			**15,350**					
Wilkinsburg—									
1911				35,600					
1912				**5,400**					
Williamsport—									
1911				1,500					
1912				**5,400**					
RHODE ISLAND.									
Cranston—									
1911						10,560	500		
1912						**10,560**			
E. Providence.									
1911						4,440	1,920		
Newport—									
1911						6,557			
Providence—									
1911						17,750	3,240		
1912						**15,000**	**3,000**		
SOUTH CAROLINA.									
Charleston—									
1911				5,100			1,000		
Columbia—									
1911		7,960	443					1,772	
1912	**5,280**	**2,640**		**2,600**					
Greenville—									
1911	15,680				1,000	300			
1912			**4,500**						
Orangeburg—									
1912				**1,320**					
SOUTH DAKOTA.									
Aberdeen—									
1912				**1,800**					
Mitchell—									
1912					**9,000**				
Rapid City—									
1912						**12,600**			
TENNESSEE.									
Clarksville—									
1911						5,700			
1912						**4,000**			
Columbia—									
1911						1,000			
1912			**5,280**						
Harriman—									
1911						3,250			
Knoxville—									
1911	11,940				1,000				
Memphis—									
1911								6,300	
McKenzie—									Gravel
1912									15,000
TEXAS.									
Abilene—									
1911		7,200							
Austin—									
1911		10,000						720	
1912		**7,000**			**1,000**			**2,100**	
Beaumont—									
1911		1,900		45,000				3,000	
1912	**9,000**		**9,000**					**9,000**	
Cuero—								Gravel and clay	
1911									10,000
1912									**10,000**
Dallas—									
1911		22,000	6,200	4,800				17,400	
Ft. Worth—									
1911		33,600							
Greenville—									
1911		19,400			900			7,200	
Paris—									
1911	9,900								
1912	**6,900**		**1,500**						
San Angelo—									
1911								6,900	
1912			**12,000**					**7,500**	

City	Asphalt	Bitulithic	Bituminous	Brick	Concrete	Macadam	Granite	Wood	Others
San Antonio—									
1911	.....	.....	18,000	.....	.....	.....	.....	.....	66,000
Terrell—									Undecided
1911	.....	.....	.....	.....	.....	.....	.....	.....	**2,400**
Waxahachie—									
1912	.....	.....	.....	.....	.....	**110,000**	.....	.....	.....
UTAH.									
Logan—									
1912	.....	**10,800**	.....	.....	.....	.....	.....	.....	.....
Salt Lake City—									
1911	10,812	.....	.....	.....	.....	.....	.....	.....	.....
VERMONT.									
Barre—									
1911	.....	.....	.....	.....	.....	1,825	566	.....	.....
Brattleboro—									
1911	.....	.....	.....	.....	.....	.....	.....	.....	2,500
1912	.....	.....	.....	.....	.....	.....	.....	.....	**3,000**
St. Albans—									
1911	.....	.....	3,000	.....	.....	2,400	.....	.....	.....
1912	.....	.....	**2,400**	.....	.....	**600**	.....	.....	.....
VIRGINIA.									
Covington—									
1912	.....	.....	.....	**450**	.....	.....	.....	.....	.....
Danville—									
1912	.....	.....	.....	**2,700**	.....	.....	.....	.....	.....
E. Radford—									
1912	.....	.....	**2,640**	.....	.....	.....	.....	.....	.....
Fredericksburg—									
1911	.....	.....	.....	.....	.....	.....	900	.....	.....
1912	.....	.....	.....	.....	.....	**3,900**	.....	.....	.....
Newport News—									
1911	.....	.....	.....	.....	.....	2,490	.....	.....	.....
Norfolk—									
1911	.....	.....	.....	.....	.....	.....	.....	4,500	.....
Portsmouth—									
1911	.....	20,069	.....	.....	.....	.....	.....	.....	.....
Richmond—									
1911	.....	.....	.....	.....	.....	.....	.....	600	.....
WASHINGTON.									
Aberdeen—									
1911	22,000	.....	.....	.....	.....	.....	.....	.....	.....
Bellingham—									Gravel
1911	6,336	.....	.....	800	.....	.....	.....	2,024	4,710
1912	**21,310**	.....	**2,250**	**640**	.....	.....	.....	.....	.....
Centralia—									
1911	.....	4,200	.....	.....	.....	.....	.....	.....	.....
Colfax—									
1911	.....	10,400	.....	.....	.....	.....	.....	.....	.....
Dayton—									
1911	.....	7,500	.....	.....	.....	.....	.....	.....	.....
Everett—									
1911	19,300	.....	.....	1,500	900	.....	.....	3,000	.....
Hoquiam—									
1911	1,191	2,114	.....	.....	.....	.....	.....	.....	.....
1912	.....	**3,800**	.....	.....	.....	.....	.....	.....	.....
Kelso—									
1911	.....	7,790	.....	.....	.....	.....	.....	.....	.....
Kent—									
1911	.....	.....	.....	.....	2,500	.....	.....	.....	.....
1912	.....	.....	.....	.....	**3,000**	.....	.....	.....	.....
N. Yakima—									
1911	2,400	14,000	.....	2,330	.....	.....	.....	.....	.....
1912	.....	.....	.....	**3,000**	.....	.....	.....	.....	**3,900**
Pasco—									
1911	.....	17,600	.....	.....	.....	.....	.....	.....	.....
Puyallup—									
1911	.....	4,800	.....	.....	4,500	.....	.....	.....	.....
Port Angeles—									
1912	.....	.....	.....	.....	.....	.....	.....	.....	**4,000**
Seattle—									Sandstone
1911	79,674	.....	.....	38,702	.....	.....	2,482	59,136	9,979
1912	**49,900**	.....	.....	**24,400**	.....	.....	**1,500**	.....	**2,500**
Snohomish—									
1911	.....	.....	.....	1,344	.....	.....	.....	.....	.....
Spokane—									
1911	49,368	.....	264	28,618	23,390	10,243	.....	.....	.....
Tacoma—									
1911	4,940	.....	.....	6,650	3,700	.....	4,200	.....	.....
Walla Walla—									
1912	**6,000**	.....	.....	.....	.....	**5,600**	.....	.....	.....
WEST VIRGINIA.									
Follansbee—									
1911	.....	.....	.....	3,600	.....	.....	.....	.....	.....
1912	.....	.....	.....	**900**	.....	.....	.....	.....	.....

City	Asphalt	Bitulithic	Bituminous	Brick	Concrete	Macadam	Granite	Wood	Others
Moundsville—									
1912	.....	.....	.....	**5,280**	.....	.....	.....	.....	.....
Parkersburg—									
1911	.....	.....	.....	2,500	.....	.....	.....	.....	.....
1912	.....	.....	.....	**4,000**	.....	.....	.....	.....	.....
				WISCONSIN.					
Antigo—									
1911	.....	.....	1,500	.....	.....	900	.....	.....	.....
1912	.....	.....	.....	.....	.....	**1,200**	.....	.....	.....
Appleton—									
1911	7,500	.....	.....	.....	750	.....	.....	.....	.....
1912	**3,000**	.....	.....	.....	.....	.....	.....	.....	.....
Baraboo—									
1912	.....	.....	.....	.....	.....	**2,400**	.....	.....	.....
Burlington—									
1911	.....	.....	.....	1,000	6,300	.....	.....	.....	.....
1912	.....	.....	.....	**2,700**	**400**	.....	.....	.....	.....
Columbus—									
1911	1,500	.....	.....	.....	.....	.....	.....	.....	.....
1912	**3,500**	.....	.....	.....	.....	.....	.....	.....	.....
Delavan—									
1912	.....	.....	**1,800**	.....	.....	.....	.....	.....	.....
De Pere—									
1912	.....	.....	.....	.....	**2,900**	.....	.....	.....	.....
Fond du Lac—									
1911	.....	.....	.....	2,124	3,715	.....	.....	.....	.....
1912	.....	.....	.....	.....	**2,640**	.....	.....	.....	.....
Janesville—									
1911	.....	.....	.....	576	.....	.....	.....	.....	.....
1912	.....	.....	.....	**1,254**	**400**	.....	.....	.....	.....
Kenosha—									
1911	.....	.....	4,200	37,500	.....	2,400	.....	.....	.....
1912	**7,500**	.....	.....	**12,000**	.....	.....	.....	.....	.....
La Crosse—									
1912	.....	.....	**1,950**	**510**	.....	**1,920**	.....	.....	.....
Madison—									
1911	.....	.....	.....	.....	.....	.....	.....	750	.....
Marinette—									Gravel
1911	.....	.....	.....	18,600	.....	73,000	.....	.....	4,600
Neenah									
1912	.....	.....	.....	.....	.....	.....	.....	.....	**5,200**
Oshkosh—									
1911	2,500	.....	.....	1,640	.....	1,080	.....	.....	.....
1912	**2,580**	.....	**1,400**	.....	**1,500**	.....	.....	**900**	.....
Sheboygan—									
1911	.....	.....	3,050	7,805	5,420	840	.....	360	.....
1912	.....	.....	**1,240**	**3,730**	**12,860**	**1,195**	.....	**440**	.....
Superior—									Undecided
1911	3,265	.....	.....	2,664	1,700	5,500	.....	2,050	.....
1912	**1,950**	.....	.....	.....	.....	.....	.....	.....	**15,000**
Waukesha—									
1911	.....	.....	1,380	.....	.....	.....	.....	.....	.....
1912	.....	.....	**9,800**	**570**	.....	.....	.....	.....	.....
Waupaca—									Gravel
1911	.....	.....	.....	.....	.....	2,750	.....	.....	7,050
1912	.....	.....	.....	.....	.....	**3,400**	.....	.....	.....

SIDEWALK IMPROVEMENTS.

Official Report of Sidewalk Improvements Made to *Municipal Engineering* by the Municipal Officials of America.

The reports have been reduced to the same unit of linear feet. When the area of sidewalks was given in square feet or square yards it has been reduced to linear feet by assuming the average width of sidewalks as 5.5 feet.

The column headed "Cement" includes cement walks laid in place, concrete flags and concrete blocks.

The column headed "Others" has an explanatory word inserted immediately above the item to which it refers whenever possible.

City	Cement	Stone	Wood	Others
		ALABAMA.		
Birmingham—				
1911	22,500	.....	.....	.....
Dothan—				
1911	63,500	.....	.....	.....
New Decatur—				
1911	158,200	.....	.....	.....

City	Cement	Stone	Wood	Others
		ARIZONA.		
Jerome—				
1911	1,000	.....	.....	.....
		ARKANSAS.		
Ft. Smith—				
1911	31,400	.....	.....	.....

City	Cement	Stone	Wood	Others
Pine Bluff—				
1911	21,052	.....	.....	.....
1912	**20,000**	.....	.....	.....
CALIFORNIA.				
Alameda—				
1911	15,800	.....	.....	.....
Alhambra—				
1911	3,000	.....	.....	.....
1912	**35,100**	.....	.....	.....
East San Jose—				
1911	10,560	.....	.....	.....
Oakland				
1911	185,000	.....	.....	.....
Palo Alto—				
1911	10,000	.....	.....	.....
Pasadena—				
1911	10,560	.....	.....	.....
Portersville—				
1911	26,400	.....	.....	.....
Riverside—				
1911	501	.....	.....	.....
San Francisco—				
1911	71,753	9,035	.....	.....
San Mateo—				
1911	5,000	.....	.....	.....
1912	**10,000**	.....	.....	.....
Selma—				
1911	15,800	.....	.....	.....
Vallejo—				
1911	5,000	.....	.....	.....
1912	**10,000**	.....	.....	.....
Watsonville—				
1911	10,000	.....	.....	.....
DISTRICT OF COLUMBIA				
Washington—				brick
1911	96,000	.....	.....	1,140
COLORADO.				
Golden—				
1911	3,000	.....	.....	.....
Salida—				
1911	1,500	.....	.....	.....
1912	**10,560**	.....	.....	.....
CONNECTICUT.				
New Britain—				
1911	15,800	.....	.....	.....
Southington—				
1912	**1,000**	.....	.....	.....
Waterbury—				
1911	2,350	.....	.....	.....
FLORIDA.				
Gainesville—				
1911	5,000	.....	.....	.....
1912	**6,000**	.....	.....	.....
Pensacola—				
1911	238,000	.....	.....	.....
GEORGIA.				
Americus—				
1911	18,000	.....	.....	.....
1912	**12,600**	.....	.....	.....
Atlanta—				
1911	184,800	.....	.....	.....
Brunswick—				tile
1911	.....	.....	.....	5,280
Columbus—				
1911	5,261	.....	.....	.....
1912	**7,800**	.....	.....	.....
Rome—				
1912	**20,000**	.....	.....	.....
IDAHO.				
Boise City—				
1911	12,446	.....	.....	.....
Payette—				
1911	10,560	.....	.....	.....
1912	**21,120**	.....	.....	.....
Rexburg—				gravel
1911	7,800	.....	.....	7,500
1912	**8,000**	.....	.....	4,000
ILLINOIS.				
Anna—				
1911	1,500	.....	.....	.....
Belvidere—				
1911	35,000	.....	.....	.....
1912	**25,000**	.....	.....	.....
Canton—				brick
1911	2,000	.....	.....	3,000
Centralia—				
1912	**32,000**	.....	.....	.....
Chicago Heights—				
1911	36,900	.....	.....	.....
Collinsville—				
1911	4,550	.....	.....	.....
Danville—				
1911	26,400	.....	.....	.....
Edwardsville—				
1911	2,000	.....	.....	.....
1912	**20,000**	.....	.....	.....
Elgin—				
1911	20,116	.....	.....	.....
Elmhurst—				
1912	**1,320**	.....	.....	.....
Freeport—				
1911	5,000	.....	.....	.....
1912	**5,000**	.....	.....	.....
Forest Park—				
1911	17,177	.....	.....	.....
Galena—				
1911	3,960	.....	.....	.....
Jerseyville—				
1912	**25,000**	.....	.....	.....
Joliet—				
1911	26,300	.....	.....	.....
Lake Forest—				
1911	5,000	.....	.....	.....
Lincoln—				
1911	10,560	.....	.....	.....
Marengo—				
1911	2,640	.....	.....	.....
Mattoon—				
1911	7,000	.....	.....	.....
1912	**10,000**	.....	.....	.....
Moline—				
1911	15,800	.....	.....	.....
Mt. Pulaski—				brick
1911	1,200	.....	.....	5,280
Oak Park—				
1911	55,804	.....	.....	.....
Paris—				
1911	850	.....	.....	.....
1912	**2,500**	.....	.....	.....
Pekin—				
1912	**10,000**	.....	.....	.....
Peoria—				
1911	105,600	.....	.....	.....
Robinson—				
1911	2,000	.....	.....	.....
Rock Island—				
1911	8,700	.....	.....	.....
Taylorville—				
1911	43,200	.....	.....	.....
Waukegan—				
1911	5,000	.....	.....	.....
1912	**5,000**	.....	.....	.....
Wheaton—				
1911	7,000	.....	.....	.....
INDIANA.				
Anderson—				
1911	29,060	.....	.....	.....
Brazil—				
1911	10,560	.....	.....	.....
Columbus—				
1911	1,320	.....	.....	.....
Crawfordsville—				
1911	2,500	.....	.....	.....
Ft. Wayne—				
1911	79,200	.....	.....	.....
1912	**52,800**	.....	.....	.....
Indianapolis—				
1911	72,746	.....	.....	.....
1912	**96,948**	.....	.....	.....
Kokomo—				
1911	27,300	.....	.....	.....
1912	**33,300**	.....	.....	.....
Lebanon—				
1911	5,280	.....	.....	.....

City	Cement	Stone	Wood	Others
Ligonier—				
1911.....	15,800	.....	.....	.....
1912.....	**10,560**	.....	.....	.....
Logansport—				
1911.....	3,000	.....	.....	.....
Marion—				
1911.....	1,670	.....	.....	.....
Martinsville—				
1911.....	5,280	.....	.....	.....
Mishawaka—				
1911.....	10,450	.....	.....	.....
Mt. Vernon—				
1911.....	1,800	.....	.....	.....
1912.....	**3,000**	.....	.....	.....
Muncie—				
1911.....	4,080	.....	.....	.....
New Castle—				
1911.....	20,000	.....	.....	.....
1912.....	**25,000**	.....	.....	.....
N. Vernon—				
1911.....	50,000	.....	.....	.....
Peru—				
1911.....	3,000	.....	.....	.....
Portland—				
1911.....	5,280	.....	.....	.....
Richmond—				
1911.....	52,800	.....	.....	.....
1912.....	**40,000**	.....	.....	.....
Rushville—				
1911.....	6,000	.....	.....	.....
Seymour—				
1911.....	2,000	.....	.....	.....
1912.....	**1,500**	.....	.....	.....
Sullivan—				
1911.....	7,920	.....	.....	.....
Veedersburg—				
1911.....	6,000	.....	.....	.....
Wabash—				
1911.....	6,432	.....	.....	.....
1912.....	**4,000**	.....	.....	.....
Whiting—				
1911.....	7,255	.....	.....	.....
Wolcottville—				
1911.....	1,500	.....	.....	.....
IOWA.				
Burlington—				
1911.....	26,400	.....	.....	.....
Carroll—				
1912.....	**1,000**	.....	.....	.....
Cedar Falls—				
1912.....	**6,000**	.....	.....	.....
Centerville—				
1911.....	5,280	.....	.....	.....
Council Bluffs—				
1911.....	29,600	.....	.....	.....
1912.....	**23,200**	.....	.....	.....
Decorah—				
1911.....	4,100	.....	.....	.....
Des Moines—				brick
1911.....	5,900	.....	.....	7,900
Fairfield—				
1911.....	15,840	.....	.....	.....
1912.....	**10,500**	.....	.....	.....
Indianola—				
1911.....	5,280	.....	.....	.....
Manchester—				
1911.....	40,000	.....	.....	.....
Mason City—				
1911.....	1,500	.....	.....	.....
1912.....	**2,000**	.....	.....	.....
Newton—				
1911.....	10,560	.....	.....	.....
1912.....	**10,560**	.....	.....	.....
Sioux City—				
1911.....	10,000	.....	.....	.....
Waterloo—				
1911.....	36,400	.....	.....	.....
1912.....	**40,000**	.....	.....	.....
KANSAS.				
Abilene—				
1911.....	52,800	.....	.....	.....
Arkansas City—				
1911.....	45,500	.....	.....	.....
Coffeyville—				
1911.....	.....	.....	22,000	.....
1912.....	.....	.....	**30,000**	.....

City	Cement	Stone	Wood	Others
Emporia—				
1911.....	7,920	.....	.....	.....
1912.....	**11,700**	.....	.....	.....
Hutchinson—				
1911.....	52,800	.....	.....	.....
Manhattan—				
1911.....	15,800	.....	.....	.....
Ottawa—				
1911.....	25,000	.....	.....	.....
Parsons—				brick
1911.....	4,000	.....	.....	5,000
1912.....	**2,000**	.....	.....	5,000
Salina—				brick
1911.....	2,000	.....	.....	5,000
KENTUCKY.				
Ashland—				
1911.....	21,100	.....	.....	.....
Dayton—				
1911.....	2,000	.....	.....	.....
1912.....	**2,000**	.....	.....	.....
Lexington—				
1911.....	20,000	.....	.....	.....
1912.....	**15,000**	.....	.....	.....
Louisville—				brick
1911.....	32,867	.....	.....	2,984
1912.....	**33,000**	.....	.....	**3,000**
Ludlow—				
1911.....	800	.....	.....	.....
1912.....	**8,000**	.....	.....	.....
Maysville—				
1911.....	5,280	.....	.....	.....
Pineville—				
1911.....	200	.....	.....	.....
LOUISIANA.				
Morgan City—				
1911.....	10,560	.....	.....	.....
Opelousas—				
1911.....	23,500	.....	.....	.....
MAINE.				
Gorham—				
1911.....	3,000	.....	.....	.....
Skowhegan—				
1911.....	800	.....	.....	.....
1912.....	**800**	.....	.....	.....
MASSACHUSETTS.				
Easthampton—				tar
1911.....	.....	.....	.....	2,500
1912.....	**2,600**	.....	.....	.....
Greenfield—				
1911.....	5,000	.....	.....	.....
Lawrence—				tar
1911.....	8,245	853	.....	25,907
New Bedford—				
1911.....	14,000	.....	.....	.....
North Adams—				
1911.....	3,948	.....	.....	8,909
North Attleboro—				
1911.....	2,640	.....	.....	.....
Somerville—				brick
1911.....	18,570	.....	.....	7,417
1912.....	**$30,000 appropriated for granolithic and others.**			
Springfield—				brick
1911.....	3,973	.....	.....	5,133
1911.....	.....	.....	.....	823
Westfield—				tar
1911.....	2,910	5,360	.....	3,190
MICHIGAN.				
Allegan City—				
1911.....	5,000	.....	.....	.....
Battle Creek—				
1911.....	7,300	.....	.....	.....
Cadillac—				
1911.....	1,400	.....	.....	.....
Gladwin—				
1911.....	5,000	.....	.....	.....
Holland—				
1911.....	10,560	.....	.....	.....
1912.....	**10,560**	.....	.....	.....
Jackson—				
1911.....	29,000	.....	.....	.....
Kalamazoo—				
1911.....	10,560	.....	.....	.....
1912.....	**10,560**	.....	.....	.....

City	Cement	Stone	Wood	Others
Lapeer—				
1911.....	7,200	.....	.....	.....
1912.....	**5,000**	.....	.....	.....
Marine City—				
1911.....	3,000	.....	.....	.....
Menominee—				
1911.....	11,700	.....	.....	.....
Monroe—				
1911.....	8,800	.....	.....	.....
1912.....	**8,000**	.....	.....	.....
Mt. Clemens—				
1911.....	3,000	.....	.....	.....
Pontiac—				.cross-walks
1911.....	105,900	.....	.....	3,600
1912.....	**180,000**	.....	.....	7,200
Port Huron—				
1911.....	5,280	.....	.....	.....
St. Clair—				
1911.....	15,000	.....	.....	.....
St. Johns—				
1911.....	1,800	.....	.....	.....
St. Joseph—				
1911.....	10,600	.....	.....	.....
1912.....	**9,000**	.....	.....	.....

MINNESOTA.

Albert Lea—				
1911.....	4,000	.....	.....	.....
1912.....	**1,000**	.....	.....	.....
Bemidji—				
1911.....	$8,798	.....	.....	.....
1912.....	**$2,000**	.....	.....	.....
Cloquet—				
1911.....	9,000	.....	.....	.....
Crookston—				
1911.....	11,400	.....	.....	.....
Eveleth—				
1911.....	18,000	.....	18,149	.....
Faribault—				
1911.....	900	.....	.....	.....
1912.....	**900**	.....	.....	.....
Fairmont—				
1911.....	6,000	.....	.....	.....
Mankato—				
1911.....	6,000	.....	.....	.....
1912.....	**2,000**	.....	.....	.....
Montevideo—				
1911.....	1,990	.....	.....	.....
1912.....	**1,800**	.....	.....	.....
Red Wing—				
1912.....	**5,000**	.....	.....	.....
Stillwater—				
1911.....	7,920	.....	.....	.....
Two Harbors—				
1911.....	31,440	.....	.....	.....

MISSISSIPPI.

Clarksdale—				
1911.....	5,800	.....	.....	.....
Columbus—				
1911.....	6,000	.....	.....	.....
1912.....	**1,500**	.....	.....	.....
Itta Bena—				
1911.....	5,280	.....	.....	.....
Jackson—				
1912.....	**8,000**	.....	.....	.....
Vicksburg—				
1911.....	10,560	.....	.....	.....
1912.....	**10,560**	.....	.....	.....

MISSOURI.

Bethany—				
1911.....	4,000	.....	.....	.....
Boonville—				
1911.....	7,550	.....	.....	.....
Caruthersville—				
1911.....	3,000	.....	.....	.....
1912.....	**3,000**	.....	.....	.....
Kansas City—				
1911.....	$74,246	.....	.....	.....
1912.....	**$95,000**	.....	.....	.....
Lexington—				
1911.....	1,800	.....	.....	.....
Liberty—				
1911.....	27,000	.....	.....	.....
Moberly—				
1911.....	15,800	.....	.....	.....
Nevada—				
1911.....	20,000	.....	.....	.....
Oregon—				
1911.....	1,500	.....	.....	.....
St. Joseph—				
1911.....	1,300	.....	.....	.....
Sedalia—				
1911.....	42,250	.....	.....	.....
1912.....	**52,600**	.....	.....	.....
Springfield—				
1912.....	**40,000**	.....	.....	.....
Webb City—				
1911.....	24,500	.....	.....	.....

MONTANA.

Billings—				
1911.....	50,000	.....	.....	.....
Bozeman—				
1911.....	45,000	.....	.....	.....
Glasgow—				
1911.....	9,100	.....	.....	.....
Helena—				
1911.....	20,900	.....	.....	.....
Laurel—				
1911.....	.....	.....	21,120	.....
Lewiston—				
1911.....	10,500	.....	.....	.....

NEBRASKA.

Chadron—				
1911.....	1,900	.....	.....	.....
Lincoln—				brick
1911.....	32,183	.....	.....	2,276
Norfolk—				
1911.....	24,200	.....	.....	.....
1912.....	**20,000**	.....	.....	.....

NEW HAMPSHIRE.

Keene—				
1912.....	**$2,000 appropriated for cement or art stone.**			
Laconia—				tar
1911.....	.....	.....	.....	1,000
1912.....	**1,000**	.....	.....	.....

NEW JERSEY.

Bayonne—				
1911.....	.....	3,160	.....	.....
Bloomfield—				
1911.....	15,840	.....	.....	.....
Egg Harbor—				
1911.....	4,500	.....	.....	.....
Glen Ridge—				
1912.....	**1,500**	.....	.....	.....
Irvington—				
1911.....	.....	10,900	.....	.....
Millville—				
1911.....	21,150	.....	.....	.....
Newark—				
1911.....	21,748	147,839	.....	.....
Ocean City—				
1911.....	5,000	.....	.....	.....
1912.....	**5,000**	**2,500**	.....	.....
Plainfield—				
1911.....	20,000	.....	.....	.....
Rutherford—				
1911.....	10,560	13,200	.....	.....
Trenton—				
1911.....	40,000	.....	.....	.....

NEW MEXICO.

Las Vegas—				
1911.....	1,500	.....	.....	.....
1912.....	**1,000**	.....	.....	.....

NEW YORK.

Auburn—				
1911.....	37,000	.....	.....	.....
1912.....	**40,000**	.....	.....	.....
Batavia—				
1911.....	2,500	.....	.....	.....
1912.....	**5,000**	.....	.....	.....
Binghamton—				
1911.....	28,964	297	.....	.....
1912.....	**30,000**	**300**	.....	.....
Buffalo—				
1911.....	301,000	.....	5,280	.....

City	Cement	Stone	Wood	Others
Corning—				
1911.....	10,560	.....	.....	.....
Dunkirk—				
1911.....	47,500	.....	.....	.....
1912.....	**26,400**	.....	.....	.....
Elmira—				
1911.....	25,000	.....	.....	.....
Geneseo—				
1911.....	21,500	.....	.....	.....
1912.....	**18,080**	.....	.....	.....
Hoosick Falls—				
1911.....	6,400	.....	.....	.....
Little Falls—				
1911.....	75,000	.....	.....	.....
1912.....	**75,000**	.....	.....	.....
North Tonawanda—				
1911.....	10,000	.....	.....	.....
1912.....	**10,000**	.....	.....	.....
Niagara Falls—				
1911.....	2,850	.....	.....	.....
Oneida—				
1911.....	2,640	.....	.....	.....
Plattsburg—				
1911.....	32,500	.....	.....	.....
Poughkeepsie—				
1911.....	35,000	.....	.....	.....
Rochester—				
1911.....	59,000	.....	.....	.....
Salamanca—				
1911.....	10,500	.....	.....	.....
Schenectady—				
1911.....	13,285	.....	.....	.....
Solvay—				
1911.....	42,200	.....	.....	.....
Syracuse—				
1911.....	49,100	.....	.....	.....
1912.....	**50,000**	.....	.....	.....
Warsaw—				
1912.....	**660**	.....	.....	.....
Watertown—				
1911.....	23,800	.....	.....	.....
White Plains—				
1911.....	10,000	.....	.....	.....
NORTH CAROLINA.				
Burlington—				
1911.....	10,560	.....	.....	.....
1912.....	**42,200**	.....	.....	.....
Greenville—				
1911.....	5,000	.....	.....	.....
1912.....	**5,280**	.....	.....	.....
Greensboro—				
1911.....	1,250	.....	.....	.....
Monroe—				gravel
1911.....	.....	.....	.....	6,000
Rocky Mount—				
1911.....	2,500	.....	.....	.....
1912.....	25,312	.....	.....	.....
Statesville—				
1911.....	31,680	.....	.....	.....
1912.....	**20,000**	.....	.....	.....
NORTH DAKOTA.				
Grand Forks—				
1911.....	8,220	.....	.....	.....
Jamestown—				
1911.....	7,920	.....	.....	.....
1912.....	**2,640**	.....	.....	.....
Valley City—				
1911.....	3,960	.....	.....	.....
1912.....	3,960	.....	.....	.....
Williston—				
1911.....	18,762	.....	.....	.....
1912.....	**15,000**	.....	.....	.....
OHIO.				
Akron—				
1911.....	30,000	.....	.....	.....
Barberton—				
1911.....	1,000	.....	.....	.....
1912.....	**2,000**	.....	.....	.....
Bellefontaine—				
1911.....	36,960	.....	.....	.....
Bowling Green—				
1911.....	10,560	Cement, stone and wood.		
Bucyrus—				
1911.....	2,945	17,114	.....	.....
Cambridge—				
1911.....	6,000	.....	.....	.....

City	Cement	Stone	Wood	Others
Canton—				brick
1911.....	500	1,000	.....	200
1912.....	**500**	**1,500**	.....	**300**
Chillicothe—				
1911.....	9,300	.....	.....	.....
1912.....	**4,800**	.....	.....	.....
Cincinnati—				
1911.....	159,800	.....	.....	.....
Conneaut—				
1912.....	**7,920**	.....	.....	.....
Cleveland Hts.—				
1911.....	2,640	13,200	.....	.....
Dayton—				
1911.....	2,600	.....	.....	.....
Dennison—				
1911.....	3,500	.....	.....	.....
1912.....	**4,000**	.....	.....	.....
Euclid—				
1911.....	.....	2,640	.....	.....
Findlay—				
1911.....	7,920	.....	.....	.....
Fostoria—				
1911.....	8,000	.....	.....	.....
Galion—				
1911.....	5,280	.....	.....	.....
1912.....	**16,800**	.....	.....	.....
Greenville—				
1911.....	8,000	.....	.....	.....
1912.....	**4,000**	.....	.....	.....
Leetonia—				
1911.....	2,000	3,000	.....	.....
Lorain—				
1911.....	600	18,800	.....	.....
1912.....	.....	**20,000**	.....	.....
Marion—				
1911.....	17,592	.....	.....	.....
1912.....	**1,200**	.....	.....	.....
Massillon—				
1911.....	4,000	.....	.....	.....
Millersburg—				
1911.....	1,000	.....	.....	.....
1912.....	**3,000**	.....	.....	.....
Mt. Gilead—				
1911.....	1,000	800	.....	.....
Mt. Vernon—				
1911.....	4,000	.....	.....	.....
Newburg City—				
1912.....	**10,800**	.....	.....	.....
Newark—				
1911.....	13,000	.....	.....	.....
Niles—				
1911.....	8,000	12,000	.....	.....
Norwood—				
1911.....	5,280	.....	.....	.....
Oberlin—				
1911.....	.....	1,820	.....	.....
Piqua—				
1912.....	**260**	.....	.....	.....
Port Clinton—				
1911.....	2,000	.....	.....	.....
Ravenna—				
1912.....	**1,000**	.....	.....	.....
Sandusky—				
1911.....	16,000	.....	.....	.....
Steubenville—				
1911.....	15,800	.....	.....	.....
Wadsworth—				
1911.....	.....	15,800	.....	.....
Wapakoneta—				
1911.....	2,640	.....	.....	.....
Warren—				
1911.....	2,640	2,640	.....	.....
OKLAHOMA.				
Altus—				
1911.....	500	.....	.....	.....
1912.....	**1,000**	.....	.....	.....
Alva—				
1912.....	**1,320**	.....	.....	.....
Bartlesville—				
1911.....	2,500	.....	.....	.....
Chandler—				
1911.....	2,300	.....	600	.....
Clinton—				
1912.....	**6,000**	.....	.....	.....
Durant—				
1912.....	**15,800**	.....	.....	.....

City	Cement	Stone	Wood	Others
El Reno—				
1911	10,560	.....	.....	.....
Frederick—				
1912	**26,400**	.....	.....	.....
Sapulpa—				
1911	15,000	.....	.....	.....
Tulsa—				
1911	14,000	.....	.....	.....
Vinita—				
1911	26,400	.....	.....	.....
OREGON.				
Astoria—				
1911	5,600	.....	.....	.....
Baker City—				
1911	9,197	.....	.....	.....
Cloquille—				
1911	2,000	.....	.....	.....
The Dalles—				
1911	26,400	.....	.....	.....
Marshfield—				
1911	10,560	.....	.....	.....
Portland—				
1911	1,284,201	.....	18,566	.....
Salem—				
1911	15,800	.....	.....	.....
PENNSYLVANIA.				
Allentown—				
1911	12,000	.....	.....	.....
Bellewood—				
1911	2,000	.....	.....	.....
Bradford—				brick
1911	.....	.....	.....	12,000
1912	.....	.....	.....	**15,000**
Carbondale—				
1911	.....	7,000	.....	.....
Carlisle—				
1911	1,900	.....	.....	.....
1912	**2,000**	.....	.....	.....
Catasauqua—				
1911	2,420	.....	.....	.....
East Stroudsburg—				
1911	500	.....	.....	.....
Gallitzin—				
1911	1,000	.....	.....	.....
1912	**2,000**	.....	.....	.....
Indiana—				
1911	7,920	.....	.....	.....
1912	**5,280**	.....	.....	.....
McKees Rock				
1911	20,000	.....	.....	.....
McKeesport—				
1911	6,540	.....	.....	.....
Media—				brick
1911	2,000	.....	.....	150
Meadville—				
1911	4,000	.....	.....	.....
Mercer—				
1911	.....	1,200	.....	.....
Miners Mills—				
1912	**5,000**	.....	.....	.....
Northumberland—				
1911	3,300	.....	.....	.....
Oil City—				
1911	37,860	.....	.....	.....
1912	**12,600**	.....	.....	.....
Punxsutawney—				
1911	2,600	.....	.....	.....
Warren—				
1911	17,500	400	.....	.....
Wilkes Barre—				
1911	2,000	14,000	.....	.....
York—				
1911	10,000	.....	.....	.....
RHODE ISLAND.				
Charleston—				
1911	9,900	2,800	.....	.....
East Providence—				tar
1911	.....	.....	.....	12,000
Newport—				
1911	10,925	.....	.....	.....
Providence—				tar
1911	.....	.....	.....	8,785
Woonsocket—				tar
1911	.....	.....	.....	1,900
1912	.....	.....	.....	**300**
SOUTH CAROLINA.				
Chester—				
1911	1,000	.....	.....	.....
Greenville—				
1911	4,000	.....	.....	.....
Orangeburg—				
1912	**2,640**	.....	.....	.....
Union—				
1911	21,120	.....	.....	.....
SOUTH DAKOTA.				
Aberdeen—				
1911	13,300	.....	.....	.....
1912	**8,500**	.....	.....	.....
Hot Springs—				
1911	7,600	1,320	.....	.....
1912	**52,800**	.....	.....	.....
Madison—				
1911	12,300	.....	.....	.....
Mitchell—				
1911	7,580	.....	.....	.....
Pierre—				
1911	5,000	.....	.....	.....
Sioux Falls—				
1911	12,000	.....	.....	.....
1912	**10,000**	.....	.....	.....
Yankton—				
1911	1,000	.....	.....	.....
1912	**3,000**	.....	.....	.....
TENNESSEE.				
Columbia—				
1911	10,000	.....	.....	.....
Clarksville—				brick
1911	3,025	.....	.....	.....
1912	**5,500**	.....	.....	**5,400**
Knoxville—				
1911	21,300	.....	.....	.....
Maryville—				
1911	2,000	.....	.....	.....
1912	**5,280**	.....	.....	.....
Memphis—				
1911	52,800	.....	.....	.....
Rockwood—				
1911	10,560	.....	.....	.....
TEXAS.				
Austin—				
1911	22,700	.....	.....	.....
Dallas—				
1911	25,000	.....	.....	.....
Cuero—				
1911	1,700	.....	.....	.....
1912	**1,000**	.....	.....	.....
Paris—				
1911	26,400	.....	.....	.....
San Angelo—				
1911	7,000	.....	.....	.....
Terrell—				
1912	**31,600**	.....	.....	.....
UTAH.				
Ogden—				
1911	25,257	.....	.....	.....
Provo—				
1911	3,055	.....	.....	.....
Salt Lake City—				
1911	194,300	.....	.....	.....
VERMONT.				
Barre—				
1911	162	.....	.....	.....
Brattleboro—				
1911	5,000	.....	.....	.....
1912	**36,000**	.....	.....	.....
Enosburg Falls—				
1912	**200**	.....	.....	.....
St. Albans—				
1911	3,330	400	.....	.....
VIRGINIA.				
Chatham—				
1911	2,640	.....	.....	.....

City	Cement	Stone	Wood	Others
Danville—				
1911.....	11,200	.....	.....	.....
East Radford—				
1912.....	**5,000**	.....	.....	.....
Fredericksburg—				
1911.....	2,000	.....	.....	.....
Newport News—				
1911.....	5,200	.....	.....	.....
Portsmouth—				
1911.....	1,420	.....	.....	.....
WASHINGTON.				
Aberdeen—				
1911.....	52,000	.....	.....	.....
Bellingham—				
1911.....	34,175	.....	3,049	.....
1912.....	**11,390**	.....	.....	.....
Dayton—				
1911.....	6,480	.....	.....	.....
Everett—				
1911.....	72,900	.....	.....	.....
Hoquiam—				
1911.....	4,000	.....	.....	.....
1912.....	**7,400**	.....	.....	.....
Kent—				
1911.....	3,000	.....	2,000	.....
1912.....	**2,000**	.....	**1,200**	.....
Seattle—				
1911.....	344,150	.....	8,712	.....
1912....	**275,000**	.....	**15,000**	.....
Snohomish—				
1911.....	10,000	.....	.....	.....
1912.....	**10,000**	.....	.....	.....
Spokane—				
1911.....	447,834	.....	.....	.....
Tacoma—				
1911.....	106,174	.....	.....	.....
Walla Walla—				
1911.....	29,925	.....	.....	.....
1912....	**100,000**	.....	.....	.....
WEST VIRGINIA.				
Moundsville—				
1911.....	26,400	.....	.....	.....
Point Pleasant—				
1911.....	8,000	.....	.....	.....

City	Cement	Stone	Wood	Others
WISCONSIN.				
Antigo—				
1911.....	6,700	.....	.....	.....
Appleton—				
1911.....	46,500	.....	.....	.....
Beloit—				
1911.....	15,800	.....	.....	.....
Burlington—				
1911.....	9,500	.....	.....	.....
Columbus—				
1911.....	2,600	.....	.....	.....
Delavan—				
1911.....	15,800	.....	.....	.....
1912.....	**15,800**	.....	.....	.....
Depere—				
1911.....	23,000	.....	.....	.....
1912.....	**18,500**	.....	.....	.....
Fond du Lac—				
1911.....	52,800	.....	.....	.....
1912.....	**52,800**	.....	.....	.....
Janesville—				
1911.....	20,000	.....	.....	.....
Marinette—				
1911.....	15,800	.....	.....	.....
La Crosse—				
1911.....	13,146	.....	.....	.....
Oconto—				
1911.....	10,280	.....	.....	.....
Superior—				
1911.....	59,583	.....	4,750	.....
1912.....	**50,000**	.....	.....	.....
Waupaca—				
1911.....	1,200	.....	.....	.....
Waupun—				
1911.....	8,146	.....	.....	.....
WYOMING.				
Cheyenne—				
1911.....	10,370	.....	.....	.....
1912.....	**10,000**	.....	.....	.....
Greybull—				
1911.....	21,120*	.....	.....	.....
Laramie—				
1911.....	42,250	.....	.....	.....
Sheridan—				
1911.....	10.560*	.....	.....	.....
1911.....	2,000**	.....	.....	.....
1911.....	28,000¶	.....	.....	.....

CURB AND GUTTER.

Official Report of Curb and Gutter Improvements Made to *Municipal Engineering* by the Municipal Officials of America.

Many cities set curbs and lay gutters, separately or combined, on streets which do not receive permanent pavements. These are reported in the following table. There has been no attempt to separate them into curb, gutter and combined curb and gutter, as in many of the reports no data are given on which to base this separation. The figures given represent the total length of the improvement, which may be either curb or gutter or combined curb and gutter.

City	Concrete	Limestone	Granite	Others
ALABAMA.				
Decatur—				
1911.....	4,000	.....	.....	.....
1912.....	**4,000**	.....	.....	.....
Dothan—				
1911.....	6,400	.....	.....	.....
Florence—				
1911.....	4,200	.....	.....	.....
Gadsden—				
1911.....	2,600	.....	.....	.....
ARKANSAS.				
Fayetteville—				
1911.....	10,000	.....	.....	.....
Helena—				
1912.....	**20,000**	.....	.....	.....
Pine Bluff—				
1911.....	3,410	.....	.....	.....
1912.....	**30,000**	.....	.....	.....
CALIFORNIA.				
Alameda—				
1911.....	10,560	.....	.....	5,280
Alhambra—				
1911.....	36,600	.....	.....	.....
1912.....	**104,900**	.....	.....	.....
Fresno—				
1911.....	14,000	.....	.....	.....

City	Concrete	Lime-stone	Granite	Others
Los Angeles—				
1911.....	303,000	.....	.....	.....
Riverside—				
1911.....	1,783	.....	.....	.....
Sacramento—				
1911.....	115,708	.....	.....	.....
San Bernardino—				
1911.....	25,000	.....	.....	.....
San Francisco—				
1911.....	.....	.....	6,935	3,812
San Mateo—				
1911.....	100,000	.....	.....	.....
1912.....	**10,000**	.....	.....	.....
COLORADO.				
Florence—				
1911.....	500	.....	.....	.....
Grand Junction—				
1911.....	6,000	.....	.....	.....
Golden—				
1911.....	400	.....	.....	.....
Salida—				
1911.....	2,000	.....	.....	.....
1912.....	**4,000**	.....	.....	.....
CONNECTICUT.				
Ansonia—				
1911.....	1,500	.....	4,000	.....
1912.....	**1,500**	.....	**6,000**	.....
East Hartford—				
1911.....	500	.....	.....	.....
Hartford—				Grading
1911.....	8,000	.....	20,000	5,000
1912.....	**8,000**	.....	**30,000**	.....
Norwich—				
1911.....	500	.....	.....	.....
Southington—				
1912.....	**500**	.....	.....	.....
Waterbury—				
1911.....	15,056	.....	.....	.....
DISTRICT OF COLUMBIA.				
Washington—				
1911.....	.....	.....	40,916	.....
FLORIDA.				
Gainesville—				Grading
1911.....	5,000	.....	.....	3,000
1912.....	**15,000**	.....	.....	**10,000**
GEORGIA.				
Americus—				
1911.....	15,000	.....	.....	.....
1912.....	**10,000**	.....	.....	.....
Columbus—				
1911.....	.....	.....	12,090	.....
1912.....	.....	.....	**10,500**	.....
Dublin—				
1911.....	.....	.....	400	.....
Rome—				
1911.....	.....	.....	12,600	.....
1912.....	**5,300**	.....	**1,300**	.....
IDAHO.				
Boise City—				
1911.....	9,022	.....	.....	.....
Pocatello—				
1911.....	11,700	.....	.....	.....
ILLINOIS.				
Alton—				
1911.....	24,710	.....	.....	.....
Belvidere—				
1911.....	8,000	.....	.....	.....
Bloomington—				
1911.....	15,000	.....	.....	.....
Canton—				Sandstone
1911.....	2,300	.....	.....	2,200
1912.....	**10,000**	.....	.....	.....
Centralia—				Sandstone
1912.....	.....	.....	.....	**40,000**
Danville—				Sandstone
1911.....	.....	.....	.....	18,000
Edwardsville—				
1912.....	**20,000**	**3,600**	.....	.....
Elgin—				
1912.....	**5,476**	.....	.....	.....
Freeport—				Sandstone
1911.....	15,000	.....	.....	.....
1912.....	.....	.....	.....	**17,000**

City	Concrete	Lime-stone	Granite	Others
Highland Park—				
1911.....	27,600	Concrete and sandstone		
Jerseyville—				
1912.....	**20,000**	.....	.....	.....
Morris—				
1912.....	**14,460**	.....	.....	.....
Morrison—				Sandstone
1911.....	17,500	.....	.....	625
Mt. Carmel—				
1911.....	12,000	.....	.....	.....
1912.....	**28,000**	.....	.....	.....
Oak Park—				
1911.....	33,598	.....	.....	.....
1912.....	**25,900**	.....	.....	.....
Rochelle—				
1911.....	4,700	.....	.....	.....
Waukegan—				
1911.....	1,000	.....	.....	.....
1912.....	**15,000**	.....	.....	.....
INDIANA.				
Anderson—				
1911.....	4,406	.....	.....	.....
Bloomington—				
1911.....	4,000	.....	.....	.....
Clinton—				
1912.....	**7,200**	.....	.....	.....
Crawfordsville—				
1911.....	4,590	.....	.....	.....
East Chicago—				
1911.....	57,000	.....	.....	.....
Ft. Wayne—				
1911.....	2,000	.....	.....	.....
Indianapolis—				
1911.....	.....	89,533	3,491	.....
1912.....	.....	**120,000**	**5,000**	.....
Kokomo—				
1911.....	19,700	.....	.....	.....
1912.....	**28,000**	.....	.....	.....
Logansport—				
1911.....	1,000	.....	.....	.....
Mishawaka—				Grading
1911.....	8,566	.....	.....	2,500
Mt. Vernon—				
1912.....	**1,200**	.....	.....	.....
Muncie—				
1911.....	9,324	.....	.....	.....
New Castle—				
1911.....	15,000	.....	.....	.....
1912.....	**10,000**	.....	.....	.....
Noblesville—				
1911.....	2,920	.....	.....	.....
North Vernon—				
1911.....	11,000	.....	.....	.....
Peru—				
1911.....	2,000	.....	.....	.....
Richmond—				
1911.....	30,000	.....	.....	.....
1912.....	**20,000**	.....	.....	.....
Seymour—				Grading
1911.....	5,000	.....	.....	15,000
1912.....	**5,000**	.....	.....	**10,000**
Wabash—				
1911.....	.....	.....	.....	1,500
Washington—				
1911.....	6,800	.....	.....	.....
Whiting—				
1911.....	5,200	.....	.....	.....
IOWA.				
Ames—				
1911.....	4,038	.....	.....	.....
Carroll—				
1912.....	**8,500**	.....	.....	.....
Cedar Falls—				
1912.....	**21,000**	.....	.....	.....
Cedar Rapids—				
1912.....	**36,000**	.....	.....	.....
Council Bluffs—				
1911.....	11,009	.....	.....	.....
1912.....	**13,132**	.....	.....	.....
Creston—				
1912.....	**42,000**	.....	.....	.....
Dubuque—				
1911.....	29,153	.....	.....	.....
Fairfield—				
1912.....	**12,000**	.....	.....	.....

City	Concrete	Limestone	Granite	Others
Fort Dodge—				
1911.....	9,000	.....	.....	.....
Harlan—				
1911.....	8,400	.....	.....	.....
1912.....	**12,000**	.....	.....	.....
Manchester—				
1911.....	14,000	.....	.....	.....
1912.....	**2,000**	.....	.....	.....
Marshalltown—				
1911.....	2,400	.....	.....	.....
Muscatine—				
1911.....	10,386	.....	.....	.....
Newton—				
1912.....	**5,280**	.....	.....	.....
Sioux City—				Grading
1911.....	65,000	.....	.....	10,000
Waterloo—				
1911.....	8,000	.....	.....	.....
Webster City—				
1911.....	17,000	.....	.....	.....
1912.....	**27,000**	.....	.....	.....
Winterset—				
1911.....	2,100	.....	.....	.....
KANSAS.				
Atchison—				
1911.....	12,187	.....	.....	.....
Coffeyville—				
1911.....	9,000	.....	.....	.....
1912.....	**28,000**	.....	.....	.....
Council Grove—				
1912.....	**1,500**	.....	.....	.....
El Dorado—				
1911.....	3,000	.....	.....	.....
Emporia—				
1911.....	19,800	.....	.....	.....
1912.....	**22,000**	.....	.....	.....
Fort Scott—				
1911.....	21,640	.....	.....	.....
Great Bend—				
1911.....	5,000	.....	.....	.....
Hutchinson—				
1911.....	52,800	.....	.....	.....
Leavenworth—				
1911.....	4,697	.....	.....	.....
Lyons—				
1911.....	1,200	.....	.....	.....
McPherson—				
1911.....	6,400	.....	.....	.....
1912.....	**4,400**	.....	.....	.....
Olathe—				
1912.....	**8,000**	.....	.....	.....
Ottawa—				Grading
1911.....	22,253	.....	.....	30,000
Parsons—				
1911.....	3,000	.....	.....	.....
1912.....	**2,600**	.....	.....	.....
Salina—				
1911.....	25,000	.....	.....	.....
Topeka—				
1911.....	89,378	.....	.....	.....
Wichita—				
1911.....	117,975	.....	.....	.....
KENTUCKY.				
Dayton—				
1911.....	2,000	.....	.....	.....
1912.....	**6,400**	.....	.....	.....
Lexington—				
1911.....	15,000	2,000	.....	.....
1912.....	**12,000**	**4,000**	**6,000**	.....
Louisville—				Grading
1911.....	87,273	.....	.....	14,221
1912.....	**85,000**	.....	.....	.....
Ludlow—				
1911.....	800	.....	.....	.....
1912.....	**8,000**	.....	.....	.....
LOUISIANA.				
Lake Charles—				
1911.....	80,000	.....	.....	.....
MAINE.				
Portland—				
1911.....	.....	.....	6,783	.....

City	Concrete	Limestone	Granite	Others
MARYLAND.				
Annapolis—				
1911.....	4,711	.....	.....	.....
MASSACHUSETTS.				
East Hampton—				
1911.....	.....	.....	2,500	.....
1912.....	**2,600**	.....	.....	.....
Everett—				
1911.....	10,000	.....	.....	.....
Haverhill—				
1911.....	6,495	.....	.....	.....
Lawrence—				
1911.....	3,134	.....	15,783	.....
Medford—				
1911.....	.....	.....	6,485	.....
New Bedford—				
1911.....	21,401	.....	.....	.....
North Attleboro—				
1911.....	.....	.....	2,000	.....
1912.....	.....	.....	**2,000**	.....
Somerville—				
1911.....	.....	.....	15,957	.....
Springfield—				
1911.....	4,551	.....	6,558	.....
Westfield—				
1911.....	2,686	.....	1,495	.....
Worcester—				
1911.....	.....	.....	34,473	.....
MICHIGAN.				
Albion—				
1911.....	10,480	.....	.....	.....
Allegan City—				
1911.....	4,000	.....	.....	.....
Battle Creek—				
1911.....	15,895	.....	.....	.....
Cadillac—				Grading
1911.....	20,000	.....	.....	7,100
1912.....	**15,000**	.....	.....	**3,200**
Dowagiac—				
1911.....	6,000	.....	.....	.....
1912.....	**5,000**	.....	.....	.....
Escanaba—				
1911.....	7,270	.....	.....	.....
Flint—				
1911.....	3,493	.....	.....	.....
Hillsdale—				
1911.....	6,700	.....	.....	.....
Holland—				
1911.....	6,600	.....	.....	.....
1912.....	**15,000**	.....	.....	.....
Jackson—				
1911.....	42,000	.....	.....	.....
Kalamazoo—				
1911.....	20,000	.....	.....	.....
1912.....	**14,000**	.....	.....	.....
Lapeer—				
1911.....	5,000	.....	.....	.....
1912.....	**14,000**	.....	.....	.....
Menominee—				
1912.....	**720**	.....	.....	.....
Monroe—				
1911.....	3,500	.....	.....	.....
1912.....	**5,000**	.....	.....	.....
Mt. Clemens—				
1911.....	2,100	.....	.....	.....
1912.....	**10,000**	.....	.....	.....
Pontiac—				
1911.....	5,280	.....	.....	14,000
1912.....	**5,280**	.....	.....	**20,000**
Port Huron—				Grading
1911.....	20,000	.....	.....	10,000
St. Johns—				
1911.....	2,923	.....	.....	3,019
1912.....	**7,000**	.....	.....	.....
St. Joseph—				
1911.....	3,725	.....	.....	.....
MINNESOTA.				
Albert Lea—				
1911.....	15,500	.....	.....	.....
1912.....	**2,000**	.....	.....	.....
Cloquet—				
1911.....	500	.....	.....	.....
Crookston—				
1911.....	8,828	.....	.....	.....

City	Concrete	Lime-stone	Granite	Others
Eveleth—				
1911.....	20,389	.....	.....	.....
Faribault—				
1912.....	**6,100**	.....	**4,900**	.....
Fergus Falls—				
1911.....	1,500	.....	.....	.....
Mankato—				
1911.....	18,500	.....	.....	.....
Minneapolis—				
1911.....	401,784	.....	.....	.....
Red Wing—				
1911.....	15,028	.....	.....	.....
1912.....	**20,000**	.....	.....	.....
Stillwater—				
1912.....	**5,280**	.....	.....	.....
Winona—				
1911.....	2,375	.....	.....	.....
MISSISSIPPI.				
Clarksdale—				
1911.....	3,000	.....	.....	.....
Columbia—				
1911.....	6,600	.....	.....	.....
Itta Bena—				Grading
1911.....	.....	.....	.....	11,000
Jackson—				
1911.....	9,000	.....	.....	.....
1912.....	**20,000**	.....	.....	.....
MISSOURI.				
Bethany—				
1911.....	780	.....	.....	.....
Carrollton—				
1911.....	20,000	.....	.....	.....
Hannibal—				
1911.....	5,000	.....	.....	.....
Kansas City—				
1911.....	135,000	.....	.....	.....
1912.....	**63,000**	.....	.....	.....
Liberty—				
1911.....	10,000	.....	.....	.....
1912.....	**10,000**	.....	.....	.....
Macon—				
1911.....	5,200	.....	.....	.....
Poplar Bluff—				
1911.....	2,000	.....	.....	.....
Sedalia—				Grading
1911.....	10,560	.....	.....	7,920
1912.....	**15,800**	.....	.....	**15,000**
Springfield—				
1912.....	**81,571**	**9,005**	.....	.....
Webb City—				
1911.....	26,170	384	.....	.....
MONTANA.				
Billings—				Grading
1911.....	45,000	.....	.....	2,500
Bozeman—				
1911.....	10,600	.....	.....	.....
Helena—				
1911.....	23,265	.....	.....	.....
NEBRASKA.				
Chadron—				
1911.....	10,400	.....	.....	.....
Lincoln—				
1911.....	19,079	.....	.....	.....
Norfolk—				Grading
1911.....	5,600	.....	.....	10,000
1912.....	**24,000**	.....	.....	**15,000**
Omaha—				Sandstone
1911.....	.....	.....	.....	84,044
South Omaha—				
1911.....	61,260	.....	.....	.....
NEW HAMPSHIRE.				
Concord—				
1911.....	1,000	.....	.....	.....
Dover—				
1911.....	450	.....	.....	.....
Laconia—				
1911.....	.....	.....	500	.....
1912.....	.....	.....	**2,000**	.....
NEW JERSEY.				
Bayonne—				
1911.....	18,160	.....	.....	.....
Bloomfield—				
1911.....	26,265	.....	.....	.....
Egg Harbor—				
1911.....	1,900	.....	.....	.....
Millville—				
1911.....	1,000	.....	.....	.....
Ocean City—				Bluestone
1911.....	5,000	.....	.....	.....
1912.....	**5,000**	.....	.....	**2,500**
Rutherford—				
1911.....	3,000	.....	.....	.....
Summit—				
1911.....	8,000	.....	.....	.....
Trenton—				Grading
1911.....	40,000	.....	.....	1,350
Westfield—				
1911.....	17,662	concrete & bluestone		
NEW MEXICO.				
Las Vegas—				
1911.....	2,000	.....	.....	.....
NEW YORK.				
Albany—				
1911.....	2,000	Concrete or granite		
Auburn—				Sandstone
1911.....	6,445	.....	.....	8,655
1912.....	**15,000**	.....	.....	**9,600**
Batavia—				
1911.....	1,500	.....	.....	.....
1912.....	**1,500**	.....	.....	.....
Binghamton—				
1911.....	6,556	.....	.....	.....
1912.....	**7,000**	.....	.....	.....
Buffalo—				
1911.....	1,208	.....	.....	28,768
1912.....	.....	.....	.....	**19,090**
Cortland—				
1911.....	5,300	.....	.....	.....
Elmira—				
1911.....	1,987	.....	.....	.....
Geneseo—				
1912.....	**1,824**	.....	.....	.....
Herkimer—				
1911.....	4,388	.....	.....	.....
Jamestown—				
1911.....	500	.....	.....	.....
Kingston—				
1911.....	3,181	.....	.....	.....
Lestershire—				
1911.....	5,600	.....	.....	.....
Little Falls—				Sandstone
1911.....	2,000	1,600	.....	4,000
1912.....	.....	.....	.....	**5,000**
Middletown—				
1911.....	2,000	.....	.....	.....
NEW YORK CITY—				
Manhattan—				
1911.....	217,966	Granite and Bluestone		
Brooklyn—				
1911.....	425,000	Concrete and Bluestone		
Richmond—				
1911.....	64,559	.....	.....	.....
Norwich—				
1911.....	11,400	.....	.....	.....
1912.....	**3,800**	.....	.....	.....
Poughkeepsie—				
1911.....	14,747	Bluestone nad Sandstone		
Plattsburg—				
1911.....	9,350	.....	.....	.....
1912.....	**10,000**	.....	.....	.....
Salamanca—				
1911.....	1,600	.....	.....	.....
Schenectady—				
1911.....	.....	.....	.....	9,190
Watertown—				
1911.....	8,350	.....	.....	.....
NORTH CAROLINA.				
Greenville—				
1912.....	**1,000**	.....	.....	.....
Monroe—				
1911.....	2,640	.....	.....	....
Rocky Mount—				
1911.....	3,000	.....	.....	.....
1912.....	**17,376**	.....	.....	.....

City	Concrete	Limestone	Granite	Others
NORTH DAKOTA.				
Grand Forks—				
1911	8,000	.....	.....	.....
Jamestown—				Grading
1911	.....	.....	.....	10,560
1912	.....	.....	.....	**10,560**
Valley City—				
1911	600	.....	.....	.....
1912	**1,000**	.....	.....	.....
Williston—				Grading
1911	11,611	.....	.....	5,386
1912	**18,000**	.....	.....	**5,000**
OHIO.				
Barberton—				
1911	2,932	.....	.....	.....
1912	**8,000**	.....	.....	.....
Bowling Green—				
1911	9,395	.....	.....	.....
1912	**4,400**	.....	.....	.....
Bucyrus —				Sandstone
1911	660	.....	.....	2,300
Canton—				Brick gutter
1911	.....	.....	.....	2,000
1912	.....	.....	.....	**3,000**
Chillicothe—				
1911	9,600	.....	.....	.....
1912	**5,000**	.....	.....	.....
Circleville—				
1911	3,000	16,000	.....	.....
Conneaut—				
1912	**10,560**	.....	.....	.....
Dayton—				
1911	7,800	.....	.....	.....
Fostoria—				
1911	16,000	.....	.....	.....
1912	**20,000**	.....	.....	.....
Greenville—				Grading
1912	**1,620**	.....	.....	**1,620**
Lorain—				Sandstone
1911	.....	.....	.....	15,600
Marion—				
1911	9,580	.....	.....	.....
1912	**14,400**	**Concrete or Sandstone**		
Miamisburg—				
1911	5,000	.....	.....	.....
1912	**3,000**	.....	.....	.....
Millersburg—				
1911	2,600	.....	.....	.....
1912	**10,000**	.....	.....	.....
Mt. Gilead—				Sandstone
1911	500	.....	.....	2,600
Newburgh City—				
1912	**1,900**	**Concrete or Sandstone**		
Newark—				
1911	1,600	.....	.....	.....
Norwood—				
1911	5,000	.....	.....	.....
Piqua—				Grading
1911	.....	.....	.....	1,600
1912	.....	.....	.....	**1,600**
Ravenna—				
1911	7,600	.....	.....	.....
1912	**8,000**	.....	.....	.....
Sandusky—				
1911	10,000	.....	.....	.....
Springfield—				
1911	36,000	.....	.....	.....
Wapakoneta—				Sandstone
1911	1,500	.....	.....	3,000
Youngstown—				
1911	105,468	Concrete or Stone		
OKLAHOMA.				
Altus—				Grading
1911	16,000	.....	.....	4,000
1912	**18,400**	.....	.....	**5,000**
Alva—				
1911	26,400	.....	.....	.....
1912	**7,400**	.....	.....	.....
Bartlesville—				
1911	14,600	.....	.....	.....
1912	**16,000**	.....	.....	.....
Chickasha—				
1911	**600**	.....	.....	.....
Clinton—				Grading
1911	25,000	.....	.....	50,000
Muskogee—				
1911	150,000	.....	.....	.....
OREGON.				
Astoria—				
1911	6,405	.....	.....	.....
Baker City—				
1911	34,390	.....	.....	.....
Oregon City—				
1911	42,000	.....	.....	.....
Portland—				Wood
1911	1,384,252	.....	.....	18,566
				Grading
1911	.....	.....	.....	420,394
Roseburg—				
1911	41,266	.....	.....	.....
1912	**20,000**	.....	.....	.....
PENNSYLVANIA.				
Allentown—				
1911	12,000	.....	.....	.....
Bloomsburg—				
1911	700	.....	.....	.....
Bradford—				
1911	.....	1,000	.....	.....
1912	.....	**3,000**	.....	.....
Carbondale—				
1911	7,000	.....	.....	.....
Carlisle—				
1911	2,280	.....	.....	.....
1912	**2,000**	.....	.....	.....
Catasauqua—				
1911	2,220	.....	.....	.....
East Stroudsburg—				
1912	**5,280**	.....	.....	.....
Erie—				
1911	15,000	.....	.....	.....
Franklin—				Sandstone
1911	.....	.....	.....	3,000
Latrobe—				
1911	5,000	.....	.....	.....
Media—				
1911	.....	.....	1,500	.....
Miners Mills—				
1911	.....	.....	.....	1,000
1912	**2,500**	.....	.....	3,000
Northumberland—				
1911	300	.....	.....	.....
Oil City—				
1911	5,509	Concrete or Sandstone		
1912	.....	.....	.....	**20,350**
Pittsburgh—				
1911	97,800	.....	.....	.....
Rankin—				
1911	3,500	.....	.....	.....
Sayre—				
1911	4,000	.....	.....	.....
1912	**3,000**	.....	.....	.....
Scranton—				
1911	39,120	.....	.....	.....
Swissvale—				
1911	6,348	.....	.....	.....
1912	**28,000**	.....	.....	.....
Warren—				
1911	6,000	.....	.....	.....
West Chester—				Brick Gutter
1911	.....	.....	2,500	3,000
Wilkes Barre—				Red Stone
1911	6,463	.....	.....	32,109
				Grading
1912	.....	.....	.....	**30,690**
RHODE ISLAND.				
Cranston—				Grading
1911	.....	.....	.....	26,040
1912	.....	.....	**2,000**	.....
Newport—				
1911	.....	.....	4,480	.....
Providence—				
1911	.....	.....	34,906	.....
Woonsocket—				
1912	.....	.....	**5,280**	.....
SOUTH CAROLINA.				
Charleston—				
1911	14,987	.....	.....	.....
Orangeburg—				
1912	**13,020**	.....	.....	.....

City	Concrete	Lime-stone	Granite	Others
SOUTH DAKOTA.				
Aberdeen—				
1911.....	1,603	.....	.....	.....
1912.....	**3,000**	.....	.....	.....
Pierre—				
1911.....	1,000	.....	.....	.....
Sioux Falls—				Grading
1911.....	12,000	.....	.....	15,000
1912.....	**8,000**	.....	.....	**15,000**
Yankton—				
1911.....	600	.....	.....	.....
TENNESSEE.				
Clarksville—				
1911.....	3,300	.....	.....	.....
1912.....	**5,500**	.....	.....	.....
Harriman—				
1911.....	2,507	.....	.....	.....
Knoxville—				
1911.....	43,970 concrete or limestone.			
Maryville—				
1911.....	2,000	.....	.....	.....
TEXAS.				
Austin—				
1911.....	23,100	.....	.....	.....
Dallas—				
1911.....	213,000	.....	.....	.....
San Angelo—				
1911.....	9,000	.....	.....	.....
UTAH.				
Ogden—				
1911.....	19,462	.....	.....	.....
Salt Lake City—				
1911.....	7,384	.....	.....	.....
VERMONT.				
Barre—				
1911.....	.....	.....	565	.....
Brattleboro—				
1911.....	5,000	.....	.....	.....
1912.....	**10,000**	.....	.....	.....
St. Albans—				
1911.....	3,300	.....	400	.....
VIRGINIA.				
Covington—				
1911.....	900	.....	.....	.....
East Radford—				
1912.....	**2,000**	.....	.....	.....
Portsmouth—				
1911.....	.....	.....	3,284	.....

City	Concrete	Lime-stone	Granite	Others
WASHINGTON.				
Aberdeen—				
1911.....	31,900	.....	.....	.....
Bellingham—				Wood
1911.....	15,512	.....	1,326	7,500
1912.....	**19,753**	.....	.....	.....
Hoquiam—				
1911.....	6,432	.....	.....	2,114 grading
1912.....	.....	.....	.....	3,800 grading
Kent—				
1912.....	.....	.....	.....	**2,000** gutter
Seattle—				
1911.....	187,427	.....	44,422	596,575
1912.....	**125,000**	.....	**26,000**	**450,000**
Snohomish—				
1912.....	**8,000**	.....	.....	.....
Spokane—				
1911.....	446,160	.....	.....	.....
Walla Walla—				grading
1912.....	**20,000**	.....	.....	**5,000**
WEST VIRGINIA.				
Parkersburg—				
1911.....	2,500	5,000	.....	.....
WISCONSIN.				
Antigo—				
1911.....	5,400	.....	.....	.....
Burlington—				
1911.....	8,800	.....	.....	.....
Delavan—				
1911.....	500	.....	.....	.....
1912.....	**360**	.....	.....	.....
De Pere—				
1912.....	**6,050**	.....	.....	.....
Fond du Lac—				
1911.....	11,524	.....	.....	.....
1912.....	**5,290**	.....	.....	.....
Janesville—				
1911.....	21,926	.....	.....	.....
Marinette—				
1911.....	3,800	.....	.....	.....
Neenah—				
1911.....	3,276	.....	.....	.....
1912.....	**7,684**	.....	.....	.....
Waukesha—				grading
1911.....	3,993	.....	.....	1,500
1912.....	**21,980**	.....	.....	**4,000**

SEWER IMPROVEMENTS.

Official Report of Sewer Improvements Made to *Municipal Engineering* by the Municipal Officials of America.

City	Brick	Con-crete	Rein-forced Con-crete	Vitri-fied Pipe
ALABAMA.				
Decatur—				
1912.....	.....	.....	.....	**900**
New Decatur—				
1911.....	.....	.....	.....	274,300
ARIZONA.				
Jerome—				
1911.....	.....	.....	.....	15,850
ARKANSAS.				
Pine Bluff—				
1911.....	.....	.....	.....	4,200
1912.....	.....	.....	.....	**20,000**

City	Brick	Con-crete	Rein-forced Con-crete	Vitri-fied Pipe
CALIFORNIA.				
Alameda—				
1911.....	.....	.....	.....	4,000
Jackson—				
1912.....	.....	.....	.....	**Carload**
San Francisco—				
1911.....	.....	.....	.....	99,705
San Mateo—				
1911.....	.....	.....	.....	21,400
Vallejo—				
1911.....	.....	4,500	.....	.....
1912.....	.....	**10,000**	.....	.....
COLORADO.				
Golden—				
1911.....	.....	.....	.....	22,500

City	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
CONNECTICUT.				
Ansonia—				
1911				32,000
1912				25,000
Hartford—				
1911		3,673		9,255
Stonington—				
1912	**900**			
Waterbury*—				
1911				7,083
*3,727 feet open drain constructed in 1911.				
DISTRICT OF COLUMBIA.				
1911	16,061			100,850
FLORIDA.				
Gainesville—				
1911	1,300			
1912	**1,000**			
GEORGIA.				
Americus—				
1912				**62,800**
Columbus—				
1911				4,006
1912				**3,500**
Rome—				
1911				8,000
1912				**60,000**
IDAHO.				
Boise City—				
1911				15,430
1912		**25,000**		**25,000**
Payette—				
1911				26,390
ILLINOIS.				
Anna—				
1911				22,000
Aurora—				
1911		2,640		42,300
Belvidere—				
1912 Complete system to be installed in 1912.				
Canton—				
1911				2,600
1912				**5,000**
Centralia—				
1912				**4,000**
Chicago Heights—				
1912			**52,800**	**13,200**
Collinsville—				
1911				13,200
Danville—				
1911				52,800
Edwardsville—				
1912				**4,500**
Elgin*—				
1911		2,792		39,675
1912				**72,846**
*500 feet cast iron pipe laid in 1911; 175 feet to be laid in 1912.				
Evanston—				
1911				7,100
1912				**7,500**
Freeport—				
1911		400		39,600
1912		**800**		**10,560**
Jerseyville—				
1912				**5,000**
Joliet—				
1911				5,000
Maywood—				
1911				1,000
Marengo—				
1911				4,860
Mattoon—				
1912		**1,800**		**15,800**
Mt. Carmel—				
1911				3,000
1912				**5,700**
Normal—				
1911				3,000
Oak Park—				
1911	334			13,341
Paris—				
1911			3,850	
Pekin—				
1911	15,000			63,400
Peoria—				
1911				3,860
Rockford—				
1911				5,700
Robinson—				
1911		400		4,000
Rochelle—				
1912				**5,350**
Taylorville—				
1911				600
Waukegan—				
1911				26,400
1912				**7,920**
Wheaton—				
1912		**2,890**		
INDIANA.				
Anderson—				
1911				3,600
Columbia City—				
1911				3,500
1912				**1,000**
Crawfordsville—				
1911				5,120
Delphi—				
1911				2,800
Evansville—				
1911				20,000
Ft. Wayne—				
1911				7,915
1912				**15,800**
Indianapolis—				
1911				*78,897
1912				**75,000**
*Includes some concrete.				
Kokomo—				
1911			6,800	8,700
1912		**7,000**		**8,300**
Ligonier—				
1911				2,640
Logansport—				
1911				1,000
Marion—				
1911				1,964
Mishawaka—				
1911				4,000
Mt. Vernon—				
1911				1,500
1912				**3,600**
Muncie—				
1911				2,610
New Albany—				
1912				**$800**
New Castle—				
1911				28,000
1912				**10,000**
North Vernon—				
1911				5,500
1912				**1,500**
Peru—				
1911				10,000
Remington—				
1911				3,000
Richmond—				
1911				3,500
1912				**7,000**
Rushville—				
1912 $55,000 contract for vitrified pipe has been let.				
Seymour—				
1911				4,000
1912				**1,500**
Wabash—				
1911				4,610
1912				**2,500**
Whiting—				
1911				2,500

City	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
IOWA.				
Burlington—				
1911				5,043
1912				**9,000**
Carroll—				
1912				**6,000**
Cedar Falls—				
1912				**3,000**
Council Bluffs—				
1911				174,520
Creston—				
1912				**2,600**
Eldora—				
1911				1,500
Fairfield—				
1912				**84,500**
Fort Dodge—				
1911				10,560
Harlan—				
1911				8,000
Indianola*—				
1912				**23,780**
*Contract let for $21,749.				
Mason City—				
1911				5,280
Manchester—				
1911				1,000
1912				**2,000**
Newton—				
1911				23,680
Shenandoah—				
1912				**13,400**
Sioux City—				
1911*		300		26,600
1912		**1,600**		**40,000**
*400 feet of tunnel.				
Waterloo—				
1911				18,700
1912				**20,000**
Waukon—				
1911				26,855
Webster City—				
1911				3,960
1912				**12,000**
Winterset—				
1911				400
KANSAS.				
Argentine—				
1911	5,280			5,280
Arkansas City—				
1911			3,980	
Coffeyville—				
1911				3,000
1912				**25,000**
Emporia—				
1911				5,400
1913				**12,000**
Hutchinson—				
1911	10,560			
Lawrence—				
1911				10,560
McPherson—				
1912				**37,000**
Olathe—				
1912				**3,500**
Ottawa—				
1911			322	1,500
Parsons—				
1911				8,000
1912				**26,000**
Pittsburg—				
1911				1,120
1912				**3,600**
Salina—				
1911				8,000
KENTUCKY.				
Ashland—				
1911				1,000
Dayton—				
1911				3,000
1912				**1,500**
Lexington—				
1911		600		8,000
1912		**300**		**5,000**
Louisville				
1911				49,000
1912				**49,000**
Ludlow—				
1912				**3,000**
MAINE.				
Lewistown—				
1911				4,000
Skowhegan—				
1911				600
MASSACHUSETTS.				
Agawam—				
1912				**3,000**
Easthampton—				
1911				3,000
1912				**5,000**
Greenfield—				
1911				10,000
Lawrence*—				
1911				6,136
*865 feet concrete invert with brick arch.				
New Bedford—				
1911				10,560
North Adams—				
1911				3,017
North Attleboro—				
1911			1,000	84,500
Quincy—				
1911				24,000
Somerville—				
1911				4,645
1912 $15,000 has been appropriated for extensions.				
Springfield—				
1911		1,382		19,241
Westfield—				
1911				8,434
MICHIGAN.				
Allegan City—				
1911				5,280
Ann Arbor—				
1911				6.655
Bessemer—				
1911			820	5,492
Cadillac—				
1911				2,500
1912				**4,000**
Dowagiac—				
1911				6,000
1912				**5,000**
Gladwin—				
1911				1,000
Holland—				
1911				16,000
1912				**7,000**
Jackson—				
1911			5,000	19,000
1912			**5,000**	**19,000**
Kalamazoo—				
1911				15,000
Lapeer—				
1911				3,000
1912				**4,000**
Marine City—				
1911		3,000		
Marshall—				
1911				3,500
Menominee—				
1911				1,200
Monroe—				
1911				1,300
1912				**2,500**
Mt. Clemens—				
1911				900
1912				**1,200**
Norway—				
1911				2,000

City	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Pontiac*—				
1911	.....	.....	.....	20,450
1912	.....	.....	.....	**40,000**
*6,000 feet open drains constructed in 1911; 12,000 feet for 1912.				
Port Huron—				
1911	.....	.....	.....	3,500
St. Clair—				
1911	.....	.....	.....	3,000
St. Johns—				
1911	.....	.....	.....	840
1912	.....	.....	.....	**3,400**
St. Joseph—				
1911	.....	.....	.....	4,150
1912	.....	.....	.....	**1,300**
Sturgis—				
1912	.....	.....	.....	**35,000**
MINNESOTA.				
Albert Lea—				
1911	.....	.....	.....	18,676
1912	.....	.....	.....	**15,000**
Bemidji—				
1911	.....	.....	.....	$3,526
1912	.....	.....	.....	**$1,400**
Cloquet—				
1911	.....	.....	.....	10,000
Faribault—				
1911	.....	.....	363	5,120
1912	.....	.....	.....	**4,000**
Fairmount—				
1911	.....	.....	.....	7,200
Mankato—				
1911	.....	.....	.....	4,000
1912	.....	.....	.....	**10,000**
Montevideo—				
1911	.....	.....	.....	5,300
Red Wing—				
1912	.....	.....	**600**	**8,000**
Stillwater—				
1911	.....	.....	.....	2,500
1912	.....	.....	.....	**4,000**
St. Paul—				
1911	.....	.....	5,280	40,000
Winona—				
1911	.....	.....	.....	2,000
MISSISSIPPI.				
Itta Bena—				
1911	.....	.....	.....	2,000
Jackson—				
1912	.....	.....	.....	**9,000**
Vicksburg—				
1912	.....	.....	.....	**7,500**
MISSOURI.				
Bethany—				
1911	.....	.....	85	.....
Brookfield—				
1911	.....	.....	.....	2,640
Boonville—				
1911	.....	.....	.....	1,684
Kansas City*—				
1911	$500,000	.....	.....	.....
1912	**$750,000**	.....	.....	.....
*Includes concrete, reinforced concrete, vitrified pipe and tunnel work.				
Liberty—				
1911	.....	.....	.....	500
Moberly—				
1911	.....	.....	21,000	.....
Sedalia—				
1911	.....	.....	.....	26,400
1912	**7,960**	.....	.....	**52,800**
Webb City—				
1911	.....	.....	.....	2,135
1912 A $17,000 bond issue has been voted.				
MONTANA.				
Billings—				
1911	.....	.....	.....	7,000
Laurel—				
1911	.....	.....	.....	10,560
NEBRASKA.				
Chadron—				
1911	.....	.....	.....	4,000
Hastings—				
1911	.....	.....	.....	7,940
Lincoln—				
1911	.....	.....	.....	14,000
Norfolk*—				
1911	.....	.....	320	7,260
1912	.....	.....	.....	**5,000**
*620 feet galvanized culvert constructed in 1911; 1,000 feet for 1912.				
South Omaha—				
1911	1,328	18,530	513	10,655
1912	.....	.....	.....	**15,000**
NEW HAMPSHIRE.				
Concord—				
1911	.....	.....	.....	1,397
1912	**400**	**600**	.....	.....
Keene—				
1912	.....	.....	.....	**$2,600**
Laconia—				
1911	.....	.....	.....	2,000
1912	.....	.....	.....	**5,000**
Littleton—				
1911	.....	.....	.....	1,100
NEW JERSEY.				
Bloomfield—				
1911	.....	.....	.....	10,560
Elizabeth—				
1911	.....	.....	.....	8,011
1912	**3,000**	.....	.....	**7,000**
Glen Ridge—				
1912	.....	.....	.....	**6,000**
Jersey City*—				
1911	4,100	.....	2,640	3,590
*5,800 feet steel.				
Newark—				
1911	2,200	.....	3,250	20,600
Ocean City—				
1911	.....	.....	.....	20,000
1912	.....	.....	.....	**10,000**
Rahway—				
1912	.....	.....	.....	**5,500**
South Amboy—				
Second section of sanitary sewerage system completed in 1911.				
Trenton—				
1911	.....	1,700	.....	31,700
1912	.....	**6,000**	.....	**25,000**
NEW MEXICO.				
East Las Vegas—				
A sanitary sewerage system costing $40,000 was completed in 1911.				
Las Vegas—				
A sewerage system covering one-half of the city was completed in 1911.				
NEW YORK.				
Auburn—				
1911	.....	.....	.....	400
1912	.....	.....	.....	**9,200**
Binghamton—				
1911	.....	.....	1,722	25,257
1912	.....	.....	.....	**20,577**
Buffalo—				
1911	1,296	.....	.....	33,757
1912	**5,422**	**443**	.....	**36,760**
Corning—				
1911	.....	.....	.....	5,280
Dunkirk—				
1911	.....	.....	.....	2,640
1912	.....	.....	.....	**5,280**
Elmira—				
1911	.....	.....	.....	4,000
Geneseo—				
1911	.....	.....	.....	1,200
Kingston—				
1911	.....	.....	.....	4,000
North Tonawanda—				
1911	.....	.....	.....	10,500
1912	.....	.....	.....	**12,500**
Norwich—				
1911	.....	.....	.....	1,445
1912	.....	.....	.....	**1,200**

City	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Olean—				
1911				15,000
Oneida—				
1911				3,960
Plattsburg—				
1911				2,000
1912				**3,000**
Schenectady—				
1911				15,000
Sidney—				
1911				700
Syracuse—				
1911				19,285
1912				**20,000**
Watertown—				
1911				7,940
NORTH CAROLINA.				
Burlington—				
1911				10,560
1912				**42,250**
Greenville—				
1912				**1,000**
Hendersonville—				
1911				5,280
Wilson—				
1911				2,000
1912				**5,000**
NORTH DAKOTA.				
Grand Forks—				
1911				2,019
Jamestown—				
1911				1,320
1912				**660**
Valley City—				
1911				825
1912			**2,980**	**8,800**
Williston—				
1911				3,642
1912				**5,000**
OHIO.				
Alliance—				
1911				2,000
Ashtabula—				
1911				2,160
Barberton—				
1912				**52,800**
Bellefontaine—				
1911				122,000
Bowling Green—				
1911				5,422
1912				**6,000**
Bucyrus*—				
1911				4,940
1913				**5,000**
*1,000 feet vitrified segment laid in 1911; 4,000 feet for 1912.				
Canal Dover—				
1911				10,560
Canton—				
1911				3,000
1912				**4,500**
Chillicothe—				
1911				2,450
1912				**6,000**
Cincinnati—				
1911				15,500
1912				**13,700**
Circleville—				
1911				10,000
1912				**5,000**
Conneaut—				
1911				8,000
1912				**4,000**
Coshocton—				
1911				490
Dayton—				
1911		2,243		62,812
1912		**10,000**		**50,000**
Delaware—				
1911				6,000
Dennison—				
1912				**1,000**
East Liverpool—				
1911				2,640
Euclid—				
1911				2,640
Findlay—				
1911				5,280
Fostoria—				
1911				5,200
1912				**6,000**
Galion—				
1911				90,000
1912				**3,000**
Greenville—				
1911				2,180
Ironton—				
1911		6,200		600
Lorain—				
1911	3,902			18,274
1912	**3,000**			**13,000**
Louisville—				
1911				400
Marion—				
1911				5,070
1912				**3,500**
Miamisburg—				
1911		2,640		
1912				**2,000**
Millersburg—				
1912				**5,600**
Mingo Junction—				
1912				**500**
Mt. Gilead—				
1911				6,100
Newburg City—				
1911	11,000			
1912				**4,500**
Niles—				
1911				15,800
Piqua—				
1911	2,650			9,200
1912				**7,300**
Ravenna—				
1911				4,500
1912				**4,500**
Salem—				
1911				3,000
Sandusky—				
1911				5,000
Steubenville—				
1911	5,280			15,000
Warren—				
1911				18,500
Wapakoneta—				
1911				1,000
Zanesville—				
1911				3,000
OKLAHOMA.				
Altus—				
1911				21,800
1912				**10,560**
Alva—				
1911	5,280			17,960
Bartlesville—				
1911				1,000
1912				**20,000**
Chandler—				
1911				35,000
Clinton—				
1911				36,000
Durant—				
1912 Complete sanitary system to be constructed.				
El Reno—				
1911				30,000
Lawton—				
1911		4,000		
Muskogee*—				
*An outfall sewer costing $250,000 is being constructed.				
Norman—				
1911		1,000		15,000
Tulsa—				
1911				35,000

City	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Vinita—				
1911.....	.....	.....	.....	6,000
OREGON.				
Albany—				
1911.....	.....	.....	.....	6,000
Baker City—				
1911.....	.....	.....	.....	14,014
Marshfield—				
1911.....	.....	.....	.....	7,920
Portland*—				
1911.....	.....	.....	20,042	213,853
1912.....	.....	.....	**40,000**	**400,000**
*152,664 feet cement pipe laid in 1911; 300,000 feet for 1912.				
Roseburg—				
1911.....	.....	.....	.....	48,000
1912.....	.....	.....	.....	**2,900**
Salem—				
1911 $50,000 concrete and reinforced sewers constructed.				
The Dalles—				
1911.....	.....	.....	.....	10,560
PENNSYLVANIA.				
Bradford—				
1911.....	.....	.....	.....	1,000
1912.....	.....	.....	.....	**5,500**
Carlisle—				
1912 Complete sewerage costing $60,000 to be constructed.				
Chester—				
1911.....	.....	.....	.....	13,600
Corry—				
1911.....	.....	.....	.....	850
Erie—				
1911.....	.....	800	.....	8,907
Gallitzin—				
1912.....	.....	.....	.....	**3,000**
Harrisburg—				
1911.....	915	.....	.....	8,852
Indiana—				
1911.....	.....	.....	.....	4,000
1912.....	.....	.....	.....	**2,000**
Johnstown—				
1911.....	.....	.....	.....	9,118
Latrobe—				
1911.....	.....	.....	.....	3,500
McKees Rock—				
1911.....	.....	.....	.....	2,000
Miners Mills—				
1911.....	.....	.....	.....	500
1912.....	.....	.....	.....	**1,800**
New Castle—				
1911.....	.....	.....	.....	5,280
Norristown—				
1911.....	.....	.....	.....	2,500
Oil City—				
1911.....	.....	.....	.....	4,847
1912.....	.....	.....	.....	**7,000**
Port Allegheny—				
1911.....	.....	.....	.....	2,000
Ridgway—				
1912.....	.....	.....	.....	**5,000**
Sayre—				
1912.....	.....	.....	.....	**2,000**
Scottdale—				
1911.....	.....	.....	.....	10,560
Sharpsville—				
1911.....	.....	.....	.....	10,560
Swissdale—				
1911.....	.....	.....	.....	687
Warren—				
1911.....	.....	.....	.....	2,500
Westchester—				
1911.....	.....	.....	.....	900
Wilkes Barre—				
1911.....	1,390	.....	.....	9,003
RHODE ISLAND.				
Newport—				
1911.....	.....	.....	.....	15,184
Providence—				
1911.....	10,000	.....	.....	15,800
Woonsocket—				
1911.....	.....	.....	.....	7,920
SOUTH CAROLINA.				
Charleston*				
1911.....	.....	.....	.....	7,338
*An entire new sewer system was constructed in 1910 and 1911.				
Columbia—				
1911.....	.....	3,500	.....	7,920
1912.....	.....	**2,000**	.....	**10,560**
Greenville—				
1911.....	.....	.....	.....	18,500
Orangeburg—				
1912.....	.....	.....	.....	**1,320**
Union—				
1911.....	.....	.....	.....	1,000
SOUTH DAKOTA.				
Aberdeen—				
1911.....	.....	.....	.....	10,128
1912.....	.....	.....	.....	**12,000**
Faulkton—				
1911.....	.....	.....	.....	1,500
Lead—				
1911.....	.....	.....	.....	3,000
Lennox—				
1911.....	.....	.....	5,000	.....
Madison—				
1911.....	.....	.....	.....	31,600
Mitchell—				
1911.....	.....	.....	.....	10,560
Sioux Falls—				
1911.....	.....	.....	.....	1,300
1912.....	.....	**7,000**	.....	**92,000**
*600 feet of tunntel to be constructed during 1912.				
Yankton—				
1912.....	.....	.....	.....	**2,000**
TENNESSEE.				
Clarksville—				
1911.....	.....	.....	.....	150
1912.....	.....	.....	.....	**800**
Columbia—				
1911.....	.....	.....	.....	1,000
1912.....	.....	.....	.....	**5,280**
Harriman—				
1911.....	.....	.....	.....	1,000
TEXAS.				
Cuero—				
Sewer construction to the amount of $25,000 is contemplated.				
Dennison—				
1911.....	.....	.....	.....	10,000
El Paso—				
1911.....	.....	1,600	.....	.....
Terrell—				
The purchase of the privately owned system is being effected.				
UTAH.				
Ogden—				
1911.....	.....	21,100	.....	.....
Provo—				
1911.....	.....	.....	.....	51,831
Salt Lake City*—				
1911.....	.....	.....	.....	27,963
*2,450 feet steel constructed during 1911.				
VERMONT.				
Barre—				
1911.....	.....	.....	.....	9,554
Brattleboro—				
1911.....	.....	.....	.....	5,000
Enosburg Falls—				
1911.....	.....	.....	.....	1,120
St. Albans—				
1911.....	.....	.....	.....	700
VIRGINIA.				
East Bradford—				
1911.....	.....	.....	.....	2,000
1912.....	.....	.....	.....	**2,640**

City	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
WASHINGTON.				
Aberdeen—				
1911	.....	.....	.....	10,560
Bellingham*—				
1911	.....	2,348	.....	.....
1912	.....	**6,500**	**750**	.....
*23,247 feet drain tile laid in 1911; 6,087 for 1912.				
Everett—				
1911	7,798	.....	2,971	25,454
Hoquiam—				
1911	.....	.....	.....	4,409
1912	.....	.....	.....	**7,300**
Kent—				
1912	.....	.....	.....	**6,000**
Pullman—				
1911	.....	.....	.....	5,000
Seattle—				
1911	3,680	41,325	.....	189,421
1912	**5,500**	**25,000**	.....	**112,000**
Snohomish—				
1911	.....	.....	.....	6,437
1912	.....	.....	.....	**5,200**
Spokane—				
1911	.....	.....	.....	47,483
Tacoma—				
1911	.....	6,072	8,712	19,000
Walla Walla—				
1912	.....	**23,000**	.....	.....
WEST VIRGINIA.				
Fairmont—				
1911	.....	.....	.....	2,640
Middlebourne—				
1911	.....	.....	.....	3,000
Moundsville—				
1912	.....	.....	.....	**147,840**
Parkersburg—				
1911	.....	.....	.....	4,560
WISCONSIN.				
Ashland—				
1911	.....	.....	.....	6,220
1912	.....	.....	.....	**10,000**
Beloit—				
1911	.....	.....	.....	10,560
1912	.....	.....	.....	**10,560**
Burlington—				
1911	.....	.....	.....	4,300
Columbus—				
1911	2,000	.....	.....	.....
1912	**1,500**	.....	.....	.....
Delavan—				
1911	.....	.....	.....	5,000
Depere—				
1911	.....	.....	.....	2,000
1912	.....	.....	.....	**15,000**
Fond du Lac—				
1911	.....	.....	.....	5,800
1912	.....	.....	.....	**5,000**
Janesville—				
1911	10,500	.....	.....	.....
1912	**5,540**	.....	.....	.....
La Crosse—				
1911	.....	.....	.....	2,330
1912	.....	.....	.....	**23,750**
Milwaukee—				
1911	26,400	.....	.....	36,960
Neenah—				
1911	.....	.....	.....	1,581
Portage—				
1911	.....	.....	.....	47,500
Racine—				
1911	.....	.....	.....	1,600
Sheboygan—				
1911	.....	.....	.....	11,986
1912	.....	.....	.....	**3,000**
Superior—				
1911	.....	.....	.....	5,369
Waupaca—				
1911	.....	.....	.....	7,721
Waukesha—				
1911	.....	.....	.....	9,489
WYOMING.				
Cheyenne—				
1911	.....	.....	.....	2,765
1912	.....	.....	.....	**2,000**
Cowley—				
1912	**System under construction.**			
Thermopolis—				
1912.	**System under construction.**			

SEWAGE DISPOSAL AND PUMPING PLANTS.

ARKANSAS.

Pine Bluff—The city will purchase 9 flush tanks and 9 flush tank regulators.

CALIFORNIA.

San Mateo—The city constructed a disposal system including pumps, pump pits and a septic tank at a cost of $25,000.

CONNECTICUT.

Southington—The construction of a sand filter system is contemplated. T. N. and S. N. McKenney, engineers.

IDAHO.

Payette—The city will construct a sewage pumping plant.

ILLINOIS.

Anna—The construction of a septic tank is contemplated.

Freeport—The city constructed a pumping plant of 800-gal. per minute capacity and installed 4 flush tanks during 1911.

INDIANA.

North Vernon—Four flush tanks were installed in 1911 and 2 more will be purchased in 1912.

IOWA.

Fairfield—The installation of a complete sewage disposal system to cost about $16,000 is contemplated.

Newton—The construction of a septic tank is contemplated.

KANSAS.

Coffeyville—A sewage treatment plant to cost about $5,000 is contemplated.

Council Grove—A construction of a complete sewerage system and disposal plant to cost $25,000 is contemplated.

Hutchinson—A construction of a sewage pumping plant of 1,000,000-gal. per day capacity is contemplated.

Parsons—During 1911 a sewage pumping plant and concrete septic tanks costing $25,000 were constructed.

MASSACHUSETTS.

North Attleboro—A complete sewage disposal plant including the following was constructed during 1911: 1 settling tank, 2 units; 2 electrically driven pumps; 1 flush tank and 16 sludge beds 125x150 ft.

MICHIGAN.

Cadillac—Two 6-in. pumping units with a capacity of 1,500,000-gal. per day and costing $9,000 were constructed during 1911.

Port Huron—A small sewage pumping plant will be constructed in 1912.

St. Johns—A new feeder system for the sewage farm will be constructed during 1912.

MINNESOTA.

Bemidji—Septic tanks costing about $1,000 were installed during 1911.

Montevideo—Two flush tanks were installed in 1911.

MISSISSIPPI.

Jackson—Four flush tanks were installed during 1911.

MISSOURI.

Kansas City—A pumping plant costing $1,800 was built in 1911 and $43,000 is available for sewage disposal pumps for 1912.

Sedalia—During 1911 the city constructed 4 sections each 50x70 ft. of a septic tank and 4 crushed stone filters at a cost of $11,000. One septic tank and 6 contact beds costing $15,000 will be constructed in 1912.

NEW JERSEY.

Ocean City—The city constructed a sewage disinfection plant costing $20,000 in 1912.

Trenton—A construction of an experimental sewage plant is contemplated.

NEW MEXICO.

Las Vegas—Sewage disposal by irrigation to cost $10,000 is contemplated.

NEW YORK.

North Tonawanda—A centrifugal electrically driven pumping plant was installed in 1911.

NORTH CAROLINA.

Rocky Mount—Sewage disposal plant finished in 1911, sewage being treated with hypochlorite of lime. Tanks, chemical house and pipe lines cost $7,000.

Statesville—A sewage disposal plant costing $3,800 was constructed in 1911.

OHIO.

Circleville—A pumping plant and 3 flush tanks were installed in 1911.

Conneaut—A sewage pumping plant was constructed in 1911.

Galion—A sewage disposal plant including the following items and costing $30,000 was constructed in 1911: 3 settling tanks, 5 contact beds, 88 flush tanks, 1 sludge bed and 1 sludge pump.

Mt. Gilead—A filter bed was constructed at the sewage plant in 1911.

Ravenna—Two settling tanks will be constructed in 1913 and a sewage pumping plant will be installed in 1912.

OKLAHOMA.

Altus—Two sand filters 50x50 ft., and a septic tank 80ft.x50x6 and costing $6,000 was installed in 1911.

Chandler—A 12-chamber septic tank, 28 ft. by 38 ft. by 9 ft. deep and costing $3,500 was constructed in 1911.

Durant—Construction of a complete sewage disposal plant is contemplated.

PENNSYLVANIA.

Bradford—Plans for a complete sewage disposal plant have been submitted to the state board of health.

Carlisle—A sewage disposal plant costing $40,000 is contemplated.

Indiana—Sewage disposal plant completed May 1, 1911, consists of 2 sludge tanks, dosing chamber, 1 sprinkling filter and 2 secondary settling tanks designed to treat a maximum flow of 1,000,000 gal. Operation very satisfactory.

Westchester—A sewage disposal plant costing $60,000 is under consideration.

RHODE ISLAND.

Newport—A sewage pumping plant costing $9,500 is in the process of construction.

SOUTH DAKOTA.

Aberdeen—A $200,000 bond issue for the construction of a sewage disposal plant has been sold.

Madison—The contract for the construction of a sewage disposal plant has been let for $9,908.

UTAH.

Provo—Twenty-five flush tanks were installed in 1911.

Salt Lake City—The city installed 42 flush tanks during 1911.

VERMONT.

St. Albans—The construction of a sewage disposal plant is contemplated for 1912.

WASHINGTON.

Bellingham—The city installed 1 flush tank, 3 manholes and 9 catch basins and inlets in 1911.

WISCONSIN.

Beloit—Plans have been accepted for the construction of a sewage disposal plant.

Waupaca—One flush tank was purchased in 1911.

WATER WORKS IMPROVEMENTS.

Official Reports of Water Works Improvements Made to *Municipal Engineering* by the Managers of the Water Works Plants of America.

City	Pipe	Hydrants	Valves	Meters
ALABAMA.				
Sheffield—				
1911.....	16*	.....	.....	.....
Talladega—				
1911.....	18,000*	.....	.....	.....
ARKANSAS.				
Pine Bluff—				
1911.....	7,188*	3	6	600
1912.....	.....	.....	.....	**800**
CALIFORNIA.				
Vallejo—				
1911.....	15,000*	25	.....	.....
1912.....	**10,000***	**25**	.....	**500**
COLORADO.				
Salida—				
1911.....	3,585*	6	.....	2
1912.....	**14,000†**	**6**	**20**	.....
CONNECTICUT.				
Southington—				
1912.....	**25,000***	.....	.....	.....
1912.....	**10,000‡**	.....	.....	.....
Waterbury—				
1911.....	21,605*	33	33	59
Wallingford—				
1911.....	1,500*	.....	.....	.....
DISTRICT OF COLUMBIA.				
Washington—				
1911.....152,066*		157	847	3,060
1912.....	**5,280¶**	.....	.....	**150**

City	Pipe	Hydrants	Valves	Meters
FLORIDA.				
Gainesville—				
1912	**$40,000 for mains and machinery.**			
GEORGIA.				
Americus—				
1911	15,800*	20	40	65
Atlanta—				
1911	158,400*	.....	.....	.....
Eastman—				
1911	13,200*	.....	.....	.....
1911	10,560¶	.....	.....	.....
Rome—				
1911	13,906*	23	25	72
1912	**20,000***	40	.....	.....
IDAHO.				
Lewiston—				
1911	10,560	.....	.....	.....
Payette—				
1911	21,860¶	30	.....	100
1912	**5,280¶**	.....	.....	.....
Rexburg—				
1911	3,000*	.....	.....	.....
1912	**3,000***	**6**	.....	**100**
ILLINOIS.				
Anna—				
1912	**21,000***	.....	.....	.....
Canton—				
1911	5,600*	.....	.....	.....
1912	**4,000***	.....	.....	.....
Evanston—				
1911	4,500*	.....	.....	.....
Flora—				
1912	**15,800***	.....	.....	.....
Highland Park—				
1911	3,000*	.....	.....	.....
1912	**3,200***	.....	.....	.....
Jerseyville—				
1912	**4,200***	.....	.....	.....
Joliet—				
1911	4,000*	.....	.....	.....
Mattoon—				
1911	2,700*	.....	.....	.....
1912	**5,280***	**10**	.....	.....
Maywood—				
1912	**4,890**	.....	.....	.....
Oak Park—				
1911	6,107*	23	9	324
1912	**7,643***	**19**	**10**	.....
Paris—				
1911	2,760*	.....	.....	.....
1912	**1,000***	.....	.....	.....
River Forest—				
1911	1,260	.....	.....	.....
1912	**9,650**	.....	.....	.....
Rochelle—				
1912	**2,400***	.....	.....	.....
Rockford—				
1911	50,000*	.....	.....	.....
Rock Island—				
1911	4,400*	.....	.....	.....
Waukegan—				
1911	1,500*	.....	.....	.....
1912	**1,000***	.....	**100**	.....
INDIANA.				
Bloomington—				
1911	10,560*	.....	.....	.....
Brazil—				
1911	1,500*	.....	.....	.....
Butler—				
1911	1,000*	.....	.....	.....
Clinton—				
1911	10,560v	4	.....	.....
Delphi—				
1911	.....	.....	.....	50
1912	**1,500***	.....	.....	**50**
Ft. Wayne—				
1911	608,709*	854	1,005	74,093
1912	.....	**30**	**50**	**6,000**
Hammond—				
1911	3,600*	.....	.....	.....
Indianapolis—				
1911	50,000*	.....	.....	.....
1912	**75,000***	.....	.....	.....
Ligonier—				
1911	5,280*	.....	.....	.....
Logansport—				
1911	$9,000	.....	.....	.....
Mishawaka—				
1911	12,000*	3	15	25
1911	367**	.....	.....	.....
1912	**8,000***	.....	**25**	.....
New Castle—				
1912	**10,000***	.....	.....	.....
North Vernon—				
1911	1,500*	.....	.....	.....
Peru—				
1911	14,000*	.....	.....	.....
Portland—				
1911	30 ton*	5	4	2
Rushville—				
1911	1,400*	.....	.....	.....
1912	**26,400¶**	.....	.....	.....
1912	**4,600***	.....	**4**	**50**
Seymour—				
1911	2,000*	.....	.....	.....
Whiting—				
1911	4,200*	.....	.....	.....
1912	**3,000***	.....	.....	.....
IOWA.				
Burlington—				
1911	10,560*	.....	.....	.....
Cedar Falls—				
1912	**4,000***	.....	.....	**100**
Charles City—				
1911	10,560*	.....	.....	.....
Cherokee—				
1911	1,600*	1	4	.....
Council Bluffs—				
1911	50,000*	46	55	1,000
Decorah—				
1911	.....	.....	.....	30
Eldora—				
1911	1,000*	.....	.....	.....
Fairfield—				
1911	1,000*	.....	.....	.....
1912	**2,500***	**4**	.....	.....
Harlan—				
1911	300*	.....	.....	.....
1912	**4,000***	.....	.....	.....
Iowa City—				
1911	12,000*	.....	.....	.....
Manchester—				
1911	2,500*	.....	.....	.....
Mason City—				
1911	10,560*	.....	.....	.....
Muscatine—				
1911	15,800*	.....	.....	.....
Newton—				
1911	5,280*	.....	.....	.....
1912	**5,280***	.....	.....	.....
Shenandoah—				
1912	**2,000***	.....	.....	.....
Sioux City—				
1911	30,000*	.....	.....	.....
1911	30,000‡	.....	.....	.....
Waterloo—				
1911	15,000*	.....	.....	.....
1912	**20,000***	.....	.....	.....
Webster City—				
1911	10,000*	.....	.....	.....
KANSAS.				
Abilene—				
1911	1,000*	.....	.....	.....
1911	1,000**	.....	.....	.....
1912	**1,000***	.....	.....	.....
Arkansas City—				
1911	79,100*	.....	.....	.....
Burlington—				
1911	33,000*	.....	.....	.....
Cherryvale—				
1911	36,900*	.....	.....	.....
Coffeyville—				
1912	**$59,665 appropriated for distribution system.**			
Emporia—				
1911	4,000*	.....	.....	.....
Newton—				
1911	7,000*	.....	.....	.....

City	Pipe	Hydrants	Valves	Meters
Olathe—				
1912	**5,000***	.....	.....	.....
Ottawa—				
1911	2,000*	.....	.....	.....
Pittsburg—				
1912	**$40,000 appropriation for distribution system.**			
LOUISIANA.				
Monroe—				
1912	**Cast Iron Water Mains to be laid.**			
Opelousas—				
1911	2,630*	.....	.....	.....
MAINE.				
Augusta—				
1911	2,500*	.....	.....	.....
1911	1,500**	.....	.....	.....
MARYLAND.				
Brunswick—				
1911	5,000*	.....	.....	.....
MASSACHUSETTS.				
Attleboro—				
1911	10,000*	.....	.....	.....
Easthampton—				
1911	3,000k	.....	.....	.....
1911	20,000*	50	25	.....
Lawrence—				
1911	17,185*	.....	.....	.....
1911	6,771§	42	112	197
New Bedford—				
1911	67,584*	.....	.....	.....
1912	**10,560***	.....	.....	.....
Newton—				
1911	**8,476**	**2**	**10**	.....
Revere—				
1911	7,920*	.....	.....	.....
Somerville—				
1912	**$17,000 appropriated for new work and $30,000 for maintenance.**			
Springfield—				
1911	30,000*	59	284	792
1912	**30,000***	**59**	**284**	**792**
Westfield—				
1911	12,301*	16	24	2
MICHIGAN.				
Alma—				
1911	15,800*	.....	.....	.....
1911	10,560¶	.....	.....	.....
Battle Creek—				
1911	15,800*	.....	.....	.....
Cadillac—				
1911	7,575*	4	8	12
1912	**5,450***	**20**	**10**	**100**
Detroit—				
1911	225,871	258	507	886
Jackson—				
1911	21,000*	39	75	1,800
1912	**21,000***	**39**	**75**	**1,800**
Kalamazoo—				
1911	40,000**	.....	.....	.....
1912	**15,000****	.....	.....	.....
Lapeer—				
1911	3,500*	.....	.....	.....
1911	1,600**	2	.....	.....
Marine City—				
1911	300*	.....	.....	.....
Pontiac—				
1911	15,000*	.....	.....	.....
1911	452‖	.....	.....	376
1912	**10,000***	.....	.....	**500**
1912	**700‖**	.....	.....	.....
Port Huron—				
1911	13,500*	.....	.....	.....
1912	**5,000***	.....	.....	.....
St. Joseph—				
1911	1,000*	.....	.....	100
1911	40‖	.....	.....	.....
Sturgis—				
1911	3,000*	.....	.....	.....
1912	**2,000***	.....	.....	.....
Ypsilanti—				
1911	360*	.....	.....	.....

City	Pipe	Hydrants	Valves	Meters
MINNESOTA.				
Albert Lea—				
1911	6,000*	.....	.....	.....
1912	**6,000***	.....	.....	.....
Bemidji—				
1911	$1,500*	$175	$80	$500
1912	.....	.....	.....	**$500**
Cloquet—				
1911	12,000*	17	27	110
Eveleth—				
1911	1,067*	3	19	6
Faribault—				
1911	289*	3	13	77
1912	**2,500***	.....	.....	.....
Mankato—				
1911	400*	.....	.....	.....
Montevideo—				
1911	1,835*	.....	.....	.....
1912	**400***	.....	.....	.....
Red Wing—				
1912	**8,000***	.....	.....	.....
Stillwater—				
1911	4,000*	3	3	.....
1912	**3,000***	6	**4**	.....
MISSISSIPPI.				
Clarksdale—				
1911	44,000*	.....	.....	.....
Greenville—				
1911	500*	.....	.....	.....
1912	**5,000***	.....	.....	.....
Itta Bena—				
1911	10,000‡	.....	.....	.....
Vicksburg—				
1912	**8,020***	.....	.....	.....
MISSOURI.				
Bethany—				
1912	**5,000****	**2**	.....	.....
Caruthersville—				
1911	3,000*	.....	.....	6
1912	**3,000***	.....	.....	.....
Kansas City—				
1911	$294,941	.....	.....	.....
1912	**$325,000**	.....	.....	.....
Lexington—				
1912	**Connections.**			
Liberty—				
1911	2,700*	.....	.....	.....
NEBRASKA.				
Norfolk—				
1911	.....	.....	.....	100
NEW HAMPSHIRE.				
Concord—				
1911	3,713*	13	22	.....
Littleton—				
1911	300*	.....	.....	.....
1911	2,000**	.....	.....	.....
NEW JERSEY.				
Jersey City—				
1911	16,900*	8	22	.....
Ocean City—				
1911	300‖	.....	.....	.....
1911	14,000*	20	100	300
1912	**300‖**	.....	.....	.....
1912	**10,000***	**20**	**50**	**300**
Trenton—				
1911	38,000*	.....	.....	.....
1912	**40,000***	.....	.....	.....
NEW YORK.				
Auburn—				
1911	5,600*	7	19	.....
Batavia—				
1911	12,000*	14	9	.....
1912	**12,600***	**15**	**10**	.....
Binghamton—				
1911	9,757*	12	.....	404
Buffalo—				
1911	40,960*	.....	.....	.....
1911	1,635‖	75	313	204
1912	**25,000***	.....	.....	.....
1912	**1,500‖**	**100**	**300**	**200**

City	Pipe	Hydrants	Valves	Meters
East Aurora—				
1911.....	5,000*	.....	.....	.....
1911.....	800¶	.....	.....	.....
Liberty—				
1911.....	2,000*	.....	.....	.....
1912.....	**2,000***	.....	.....	.....
Little Falls—				
1911.....	15‖	2	5	50
1912.....	**2,500***	.....	.....	.....
1912.....	**20‖**	**2**	**10**	**50**
Newburg—				
1911.....	3,168	7	17	.....
North Tonawanda—				
1911.....	1,000*	.....	.....	.....
1912.....	**3,000***	.....	.....	.....
Norwich—				
1911.....	8,020*	.....	.....	.....
Plattsburg—				
1911.....	14,100*	23	50	14
1912.....	**2,000***	.....	.....	.....
Rochester—				
1911.....	115,000*	.....	.....	.....
1912.....	**105,800***	.....	.....	.....
Solvay—				
1911.....	1,000*	.....	.....	.....
1912.....	**3,000***	.....	.....	.....
Syracuse—				
1911.....	21,800*	40	30	1,200
1911.....	20,000‖	.....	.....	.....
1912.....	**21,800***	.....	.....	.....
1912.....	**20,000‖**	**40**	**30**	**1,200**
NORTH CAROLINA.				
Greenville—				
1912.....	**2,000***	.....	.....	.....
Rocky Mount—				
1911.....	1,000*	.....	.....	.....
1912.....	**6,500***	.....	.....	.....
Statesville—				
1911.....	.....	15	.....	90
NORTH DAKOTA.				
Grand Forks—				
1911.....	2,340†	.....	.....	.....
1911.....	11,578*	12	15	.....
Jamestown—				
1911.....	10,560*	.....	.....	.....
1912.....	**5,280***	.....	.....	.....
Valley City—				
1911.....	4,500*	9	10	30
1912.....	**2,000***	6	8	30
Williston—				
1911.....	4,260*	4	.....	.....
1912.....	**27,450***	**35**	.....	.....
OHIO.				
Alliance—				
1911.....	10,000*	.....	.....	.....
1911.....	500**	.....	.....	.....
1911.....	4,000c	.....	.....	.....
1912.....	**8,000***	.....	.....	.....
1912.....	**4,000***	**36 to 42 in. conduits.**		
Barberton—				
1911.....	1,500*	.....	.....	.....
1912.....	**17,000***	.....	.....	.....
Cambridge—				
1911.....	$1,200*	.....	.....	.....
1912.....	**$1,200***	.....	.....	.....
Canton—				
1911.....	2,000*	.....	.....	.....
1912.....	**5,000***	.....	.....	.....
Conneaut—				
1911.....	1,500*	3	.....	.....
1912.....	**1,000***	**2**	.....	.....
Coshocton—				
1911.....	1,800*	1	6	.....
Dayton—				
1911.....	1,387*	.....	.....	.....
1911.....	2,325‖	50	73	1,541
1912.....	**2,600 tons***	.....	.....	.....
1912.....	**2,000‖**	**50**	**100**	**1,600**
Fostoria—				
1911.....	2,000*	.....	.....	.....
1912.....	**1,500***	.....	.....	.....
Greenville—				
1911.....	680**	.....	.....	.....
1911.....	1,300*	.....	.....	.....
Lorain—				
1911.....	2,800*	.....	.....	.....

City	Pipe	Hydrants	Valves	Meters
Miamisburg—				
1911.....	600‡	.....	.....	.....
Newburgh City—				
1911.....	25,450*	.....	.....	800
1912.....	**25,450***	.....	.....	**800**
Port Clinton—				
1911.....	1,500*	.....	.....	.....
Ravenna—				
1911.....	3,000*	5	4	.....
1912.....	**1,500**	**6**	**6**	**4**
Sandusky—				
1911.....	10,600*	16	24	500
1911.....	500‖	.....	.....	.....
Van Wert—				
1911.....	55 tons*	....	.....	.....
OKLAHOMA.				
Altus—				
1912.....	**5,280***	.....	.....	.....
Alva—				
1911.....	686,000*	.....	.....	.....
1911.....	502‖	89	26	476
1912.....	**21,800***	.....	.....	.....
Chandler—				
1911.....	1,500‡	.....	.....	$250
1912.....	**6,000‡**	.....	.....	**$1,500**
Clinton—				
1911.....	5,000*	12	.....	.....
1912.....	**5,000***	.....	.....	.....
Durant—				
1911.....	21,800*	.....	.....	25
OREGON.				
Baker City—				
1911.....	1,282	4	2	.....
Portland—				
1911.....	378,418*	623	1,483	429
1912.....	**400,000***	.....	.....	.....
PENNSYLVANIA.				
Catasauqua—				
1911.....	752‖	.....	.....	.....
1911.....	36,059*	78	73	.....
East Stroudsburg—				
1911.....	2,000*	.....	.....	.....
1912.....	**3,000***	.....	.....	.....
Media—				
1911.....	2,700*	4	10	.....
1912.....	**2,500***	.....	.....	.....
West Chester—				
1911.....	2,650*	7	6	21
SOUTH CAROLINA.				
Orangeburg—				
1911.....	660*	2	.....	40
1912.....	**1,320***	.....	.....	**40**
SOUTH DAKOTA.				
Aberdeen—				
1911.....	9,514*	.....	.....	.....
1912.....	**13,200***	.....	.....	.....
Mitchell—				
1911.....	7,300*	.....	.....	.....
1912.....	**7,000***	.....	.....	.....
Sioux Falls—				
1911.....	100 tons*	....	.....	.....
1911.....	210‡	6	.....	2,000
1912.....	**600 tons***	**10**	.....	**300**
Vermillion—				
1911.....	700*	.....	3	.....
Yankton—				
1911.....	1,200*	.....	.....	.....
1912.....	**30,000* to replace wood.**			
TENNESSEE.				
Clarksville—				
1911.....	125*	.....	.....	.....
1912.....	**1,500***	.....	.....	**200**
Harriman—				
1911.....	.....	5	.....	.....
TEXAS.				
Cuero—				
1911.....	1,200*	5	.....	.....
1912.....	**2,400***	.....	.....	.....
Denison—				
1911.....	21,800*	.....	.....	.....
Hillsboro—				
1911.....	5,280*	.....	.....	.....

City	Pipe	Hydrants	Valves	Meters
UTAH.				
American Fork—				
1911.....	1,320*	.....	.....	.....
1911.....	28,100¶	.....	.....	.....
Provo—				
1911.....	858¶	.....	17	29
1911.....	18,193c	.....	.....	.....
1912.....	**2,450†**	.....	.....	.....
Salt Lake City—				
1911.....	34,183*	52	139	.....
VERMONT.				
Barre—				
1911.....	518‡	5	.....	.....
1911.....	2,832*	.....	.....	.....
St. Albans—				
1911.....	180*	.....	.....	.....
1911.....	2,100¶	.....	.....	.....
1912.....	**10,000***	**12**	**12**	**1,000**
1912.....	**10,000**	**Vitrified tile.**		
WASHINGTON.				
Bellingham—				
1911.....	17,000¶	15	.....	.....
1911.....	333‖	.....	.....	.....
1912.....	**4,510***	**10**	**16**	.....
Kent—				
1912.....	**10,000¶**	.....	.....	.....
Seattle—				
1911.....156,333*		.....	.....	.....
1911.....	16,064†	313	304	.....
1911.....	1,185¶	.....	.....	.....
1912.....	**46,500***	.....	.....	.....
1912.....	**18,250†**	**130**	**150**	.....
Snohomish—				
1911.....	17-mile system installed.			
Spokane—				
1911.....	43,936*	.....	.....	.....
1911.....	89,979k	238	276	2,312
1911.....	16,078†	.....	.....	.....
1911.....	690‡	.....	.....	.....
1911.....	1,876‖	.....	.....	.....
1912.....	**26,400†**	.....	.....	.....
WEST VIRGINIA.				
Parkersburg—				
1911.....	6,000*	30	35	275
WISCONSIN.				
Columbus—				
1911.....	1,500*	.....	.....	.....
1912.....	**1,500***	.....	.....	.....
Delavan—				
1911.....	6,000*	.....	.....	.....
Depere—				
1911.....	2,000‖	.....	.....	100
1912.....	**15,000‖**	.....	.....	**200**
La Crosse—				
1911.....	15,978*	14	64	.....
1912.....	**10,000***	**15**	**75**	.....
Waupaca—				
1911.....	1,000*	.....	.....	.....
1911.....	540†	.....	.....	.....
1911.....	30‖	1	4	4
1912.....	**2,000***	.....	.....	.....
WYOMING.				
Cheyenne—				
1911.....	3,685*	.....	.....	.....
Sheridan—				
1911.....	21,800¶	.....	.....	.....

WATER SUPPLIES.

ALABAMA.

Dothan—The city constructed a 1,000,000-gal. reinforced concrete reservoir during 1911.

Talladega—The city constructed coal sheds, tool houses and a scales during 1911.

ARKANSAS.

Batesville—A filtration plant was constructed in 1911.

CALIFORNIA.

Alameda—A district has been formed with Oakland to obtain water from the mountain.

Portersville—A 500,000-gal. reservoir was constructed in 1911.

San Bernardino—A reservoir, the third to be constructed, was built in 1911.

San Francisco—$817,000 of contracts for fire protection water supply were completed in fiscal year ending in 1911, and $900,000 remained to complete during current year. filter plant. A high service pumping station was completed in 1911 and an entirely new low service plant is proposed for construction in 1912.

Vallejo—A 15,000,000-gal. reservoir of reinforced concrete construction was built in 1911.

Visalia—An electrically-driven 500,000-gal. centrifugal pump was installed in 1911.

COLORADO.

Golden—The earth and concrete reservoir was enlarged in 1911.

Rocky Ford—A pumping station and filtration plant was constructed in 1911.

CONNECTICUT.

Perryville—The impounding system was enlarged in 1911.

Wallingford—A 100,000,000-gal. reservoir was constructed in 1911.

FLORIDA.

Jacksonville—A 3,000,000-gal. covered reinforced concrete reservoir was constructed in 1911.

Gainesville—An appropriation of $40,000 for the purchase of machinery and the extension of the distribution system has been voted.

GEORGIA.

Americus—A 225,000-gal. concrete reservoir costing $5,000; a 1,500,000-gal. crank and fly wheel engine; a 200-h.p. return tubular boiler; and one 12-in. well were added to the supply system during 1911.

Ft. Valley—A reservoir and air compressor pumping station was constructed in 1911.

Rome—The installation of a 4,000,000-gal. steam or 2,500,000-gal. electric pumping unit and the construction of a 500,000 filter unit are contemplated for 1912.

Waynesboro—One 12x12x12 Myer air compressor has been installed.

IDAHO.

Ilo—An $11,000 bond issue for a water works system has been voted.

Payette—The construction of a pumping station and a filtration plant are contemplated for 1912.

ILLINOIS.

Anna—The construction of a 100,000-gal. tank and tower is contemplated for 1912.

Canton—A pumping station was constructed and one $2,000,000 pump, and two 150-h.p. boilers were installed in 1911. A 2,000,000-gal. pump will be installed in 1912.

Centralia—The city completed a water supply system in 1911, submerging 250 acres to an average depth of 10 ft. by the construction of an earth dam. The cost of the work was $150,000.

Downers Grove—A stand pipe was constructed in 1911.

Eureka—A 270-gallon per minute pump was purchased and a 10-in. well driven in 1911.

Fairbury—A steel tank and tower will be erected and forty meters purchased in 1912.

Mattoon—The installation of a filtration plant is contemplated by the city water works system.

Morrison—An additional artesian well is being constructed.

Mt. Carmel—The installation of a filtration unit is contemplated.

Normal—The construction of a concrete reservoir, and a brick pumping station, one deep well and the installation of 2 steam pumps is contemplated. Bids will be requested soon.

Oak Park—A pumping unit costing $11,000 was purchased in 1911.

Paris—The purchase of an additional unit is contemplated.

Quincy—A special committee has reported on local water works conditions recommending the immediate use of hypochlorite of lime, and the early construction of a complete filter plant.

San Jose—The installation of a water works system including reservoir and an air lift pumping station is contemplated.

Waukegan—The construction of a hypochlorite plant is contemplated in 1912.

Wheaton—A Nash gas producer gas engine replacing steam units was installed and additions were made to the pumping station during 1911.

INDIANA.

Bedford—The installation of two boilers and a steam driven pumping unit is contemplated for 1912.

Clinton—Two pumps and one boiler were purchased in 1911.

Ft. Wayne—Four pumps and four boilers, one air compressor and one electric pumping unit were purchased in 1911, and one pump, and one air compressor will be needed in 1912.

Hobart—The extension of the water works system is contemplated.

Indianapolis—A new pumping station and complete boiler plant will be installed by the Indianapolis Water Co. during 1912.

Logansport—A dam costing $12,000, a pump house extension, costing $2,000 and pumps costing $15,200, were added to the water works system in 1911.

Mishawaka—The purchase of two boilers and one pump to cost about $70,000 is contemplated.

New Castle—A deep well will be driven and an additional pumping unit purchased in 1912.

North Vernon—A concrete dam 15 ft. high and 150 ft. long was constructed in 1911 and in 1912 an electric pumping unit will be purchased and settling basins and filters of 1,000,000-gal. capacity will be added.

Remington—A filtration plant was built in 1911.

Rushville—Extensions to the water works system as follows are contemplated for 1912: One brick and concrete pumping station, three pumps, two motors and 5 miles of transmission line and one 14-in. well.

IOWA.

Cedar Falls—The purchase of a 2,000,000-gal. pump and the construction of a deep well is contemplated for 1912.

Cherokee—The construction of a concrete reservoir and the re-construction of a receiving reservoir, and one well were completed in 1911.

Council Bluffs—Water works extensions as follows are contemplated for 1912: A brick boiler room, one 8,000,000-gal. high duty, and 2 14,000,000-gal. centrifugal pumps, 1 air compressor, 1 steel air compressor tank and 2 100-h.p. motors.

Fairfield—The installation of a filter unit to cost about $16,000 is contemplated.

Glenwood Park—A $4,000 bond issue for water works extension has been voted.

Newton—A 100,000-gal. steel tank was completed and one Dean compound duplex steam pump was purchased in 191.

Shenandoah—The purchase of 1 Gould pump and the construction of a deep well is contemplated for 1912.

Sioux City—The following water works improvements were completed in 1911: 1 120,000-gal. steel tank, 1,000 ft. of 5-ft.x5-ft. tunnel, 2 small pumping stations and 6 16-in. wells.

Sigourney—A filtration plant was completed during 1911.

Waterloo—Two pumps were purchased, and 1 settling basin and 1 deep well were constructed during 1911.

KANSAS.

Arkansas City—A water works system costing about $100,000 and including a dam, pumping station and filtration plant was completed in 1911.

Clay Center—A 1,000,000-gal. pump was purchased in 1911.

Coffeyville—The following water works improvements are contemplated for 1912: Boilers, $11,300; filters, $32,000; settling basins, $14,800.

Emporia—Electric pumping apparatus costing $13,000 was purchased in 1911 and additional apparatus costing $4,000 is contemplated for 1912.

Lynden—J. W. Mavity is preparing plans and estimates for a water supply system for the city.

Manhattan—A 2-stage 5-in. vertical motor driven turbine pump was installed in 1911.

Newton—Water works improvements costing $3,000 were installed during 1911. They were an additional pump house, 1 pumping engine, 2 deep wells, and 3 deep well pumps.

Ottawa—Improvements to the dam and intake costing about $1,000 were completed in 1911.

KENTUCKY.

Earlington—A 150,000-gal. reservoir is completed.

Owensboro—A water softening plant was installed in 1911.

LOUISIANA.

Baton Rouge—The Baton Rouge Water Co. will require the following material for reservoir construction this fall: 130 lbs. hydrated lime, 1292 bbls. cement, 725 cu. yds. crushed stone, 263 cu. yds. sand, reinforcing bars, valves, cast iron pipe and castings.

Morgan City—A water works system was constructed in 1911.

Monroe—The construction of a dam is contemplated for 1912.

MAINE.

Augusta—Reservoir extensions were completed in 1911.

MARYLAND.

Brunswick—A 350,000-gallon concrete reservoir was completed in 1911.

Laurel—The construction of a reservoir and dam to cost about $1,000,000 is contemplated.

Myersville—The construction of a water works system is contemplated.

MASSACHUSETTS.

East Hampton—The installation of an electric indicator and 10,000 ft. of transmission line is contemplated for 1912.

Greenfield—A storage reservoir was completed in 1911.

Summerville—An appropriation of $17,000 for water works extensions and $30,000 for maintenance has been made.

Springfield—The additional cost of recent new water supply from the Little River including land damages, etc., was $78,000.

MICHIGAN.

Bessemer—Two 250-ft. wells were constructed in 1911 and 3 300-ft. wells will be constructed in 1912.

Dowagiac—A 1,500,000-gal. Canton-Hughes pump was purchased in 1911.
Grand Haven—A $60,000 bond issue for water works extension has been voted.
Hancock—An electric pumping station was constructed in 1911.
Jackson—The installation of 2 125-h.p. boilers is contemplated for 1912.
Kalamazoo—The purchase of 2 steel standpipes or tanks and towers is contemplated for 1912.
Mt. Clemens—An additional well was constructed in 1911.
Pontiac—One 2,000,000-gal. concrete reservoir was constructed in 1911.
St. Johns—A 1,000,000-gal. pumping engine was purchased in 1911.

MINNESOTA.

Cloquet—A centrifugal pump and a 90-h.p. motor were purchased in 1911, and an entire new pumping station will be added in 1912.
Duluth—A 5,000,000-gal. reservoir was constructed in 1911.
Faribault—A 12-in. artesian well, 1,385 ft. in depth was completed in 1911.
Jordan—A $7,000 bond issue for water works extension has been voted.
Mankato—A 50-000-gal. tank and tower was constructed in 1911, and the following equipment was installed: 1 125-h.p. boiler, and 1 electrically driven centrifugal pump.
Montevedio—A gravity pipe line about one-half mile in length was installed in 1911.
New Prague—A $7,000 bond issue for water works extension has been voted.
St. Peter—A concrete reservoir was constructed in 1911.
Two Harbors—One compound Nordberg pump was purchased in 1911.

MISSISSIPPI.

Clarksdale—Two pumps were purchased and an air compressor installed in 1911, and in 1912 1 250-h.p. water tube boiler will be added.
Columbus—A 200,000-gal. elevated tank and tower costing $8,500 was added in 1911.
Greenville—A Babcock and Wilcox boiler was installed during 1911.
Itta Bena—One well was constructed in 1911.
Jackson—A pumping station with 2 pumps and 2 boilers was constructed in 1911.
Vicksburg—A bond issue for a municipally owned water works system has been voted.
Yazoo City—A $30,000 bond issue for water works improvements has been voted.

MISSOURI.

Bethany—The construction of a power plant and the installation of a pumping unit is contemplated for 1912.
Boonville—A concrete reservoir was constructed in 1911, and 2 additional reservoirs will be built in 1912. The reservoir is divided into sections, a unit of which is constructed at a time.
Kansas City—A 30,000,000-gal. pumping engine at Quindaro, and a high pressure pump at Turkey Creek and other pumping equipment costing $359,427, was constructed in 1911. Additional power house improvements to cost $150,000 are contemplated for 1912.
Lexington—Additional pumping units and reservoir extensions were added in 1911.
Liberty—A 100,00-gal. steel tank is contemplated for 1912.
Mound City—A $15,000 bond issue for water works extensions has been voted.
Oregon—Pumps and boilers costing $11,500 were added in 1911.

MONTANA.

Bozeman—Extensive reservoir improvements were made in 1911.
Great Falls—The reservoirs, a filtration plant and electric pumping units were added in 1911.

NEBRASKA.

Alliance—Water works construction as follows will be completed about May 1st, 1912: Power plant, 100 ft. by 60 ft., 2 165-h.p. boilers, 1 engine direct connected to 100-k.w. Ft. Wayne generator and 1 engine direct connected to a 250-k.w. generator.
Chadron—A dam was constructed in 1911.
Lincoln—Two 1,500,000-gal. centrifugal pumps will be purchased in 1912, and 2 deep wells will be constructed.
Mason City—A $3,000 bond issue for the erection of a standpipe and the extension of water mains has been voted.
Marquette—A $9,100 bond issue for water works construction has been voted.
Norfolk—An electric pumping sub-station will be constructed in 1912.
North Platte—A $100,000 bond issue for water construction has been voted.
Tecumseh—A 125,000-gal. tank and tower was purchased in 1911.
Wymore—A pumping station was installed in 1911.

NEW JERSEY.

Beech Haven—A filtration plant was constructed in 1911.
Burlington—A mechanical filtration plant will be installed in 1912.
Millville—The purchase of the Peoples Water Co. plant and its operation by the city is contemplated.
New Brunswick—A $100,000 bond issue for water works construction has been voted.
Ocean City—An air compressor system and 1 well were added in 1911 and an additional well will be driven in 1912.
Plainfield—New wells and pumping equipment were installed in 1911.
South Amboy—A steel standpipe will be constructed in 1912.
Trenton—The city proposes to construct a mechanical filtration plant to cost about $450,000.

NEW YORK.

Batavia—A concrete reservoir containing about 600 cu. yds. was constructed, and 1 5,000,000-gal. pump was purchased during 1911. A 150-ft. brick chimney will be constructed in 1912.
Binghamton—A 5,000,000-gal. reservoir is being constructed.
Buffalo—A new pumping station containing 2 30,000,000-gal. pumps is under construction, and the purchase of 5 30,000,000-gal. pumps and 8 750-h.p. boilers is contemplated.
Cortland—The reservoir is to be enlarged and lined during 1912.
East Aurora—The reservoir was repaired and the pumping station was overhauled during 1911.
Elmira—A 5,000,000-gal. reservoir was constructed in 1911.
Frankfort—A 20,000,000-gal. reservoir was constructed during 1911.
Geneseo—An appropriation of $10,000 for the construction of a reservoir and the purchase of a steel tank has been made.
Granville—The construction of a new reservoir and water main extensions to cost $15,000 is contemplated for 1912.
Huntington—A 25,000-gal. tank was constructed during 1911.
Jamestown—Chester & Flemming, Union Bank Bldg., Pittsburgh, Pa., have been retained to prepare plans for the construction of a reinforced concrete reservoir.
Liberty—The purchase of 50 water meters is contemplated by the city.
Millerton—A filtration plant was constructed during 1911.
Mt. Morris—A $140,000 bond issue for water works construction has been voted.
Norwich—A 2,000,000-gal. centrifugal pump electrically driven was purchased in 1911.

Oneida—The installation of a water softener plant to cost about $25,000 is contemplated.

Plattsburg—An earth dam with concrete corewall costing $24,000 was completed in 1911. Additional reservoir improvements are contemplated for 1912.

NORTH CAROLINA.

Greensboro—A 2,000,000-gal. pump steam turbine driven was purchased during 1911.

NORTH DAKOTA.

Grand Forks—A 2,000,000-gal. rapid sand filter was completed in 1911.

Jamestown—An additional pumping unit was purchased in 1911.

Mandan—Three reservoirs were constructed and a filter plant completed during 1911.

Valley City—A concrete block pumping station, 2 stories in height, was completed and 2 Deming pumps direct connected to motors and having a capacity of 300 gal. per minute, were installed.

Williston—The construction of a 215,000-gal. steel tank, a 1,000,000-gal. filter and 2 pumps is contemplated for 1912.

OHIO.

Alliance—The construction of a 300,000,000-gal. reservoir and a 5,000,000-gal. standpipe is contemplated for 1912. During 1911 the following equipment was installed: 2 250-h.p. boilers, 1 feed water pump, 1 500 cu. ft. air compressor.

Bucyrus—A 3,000,000-gal. pump and 2 125-h.p. boilers were installed during 1911.

Cambridge—The construction of a water purification plant is contemplated.

Canton—A steel tank and tower and 1 pump were purchased during 1911, and 2 standpipes, 2 pumps and 15 or 20 wells will be added during 1912.

Cincinnati—General Supt. Baldwin of the water works has recommended water works improvements to the amount of $199,500.

Cleveland—Two 25,000,000-gal. pumping engines were installed during 1911, and during a part of the winter season a temporary hypochlorite plant was in use.

Coshocton—Three wells were constructed during 1911.

Crooksville—Consulting Engineer Maddox, Newark, O., has been retained to prepare plans for a complete water works system. A joint system with Roseville is contemplated.

Dayton—The following work was completed by the city water works during 1911, a steel dam, 3,000,000-gal. reinforced reservoir, 1 steel standpipe, 1 pumping station, 3 3,500,000-gal. per minute pumps, 1 vacuum pump, 3 50-h.p. motors and 40 8-in. wells.

Dennison—All steam apparatus was replaced by electric motors during 1911.

East Liverpool—A pumping station was constructed during 1911.

Junction City—The installation of a water works system is contemplated.

Lisbon—A $10,000 bond issue for water works improvements has been voted.

Lorrain—An engine room and 2 settling basins were completed in 1911. In 1912 an engine will be purchased and a pump house and 2 settling basins will be constructed at a cost of about $52,000.

Mingo Junction—The purchase of a private water works system which has been in operation for about 15 years is contemplated by the village. Estimated cost, $65,000.

Port Clinton—A filtration plant costing $17,000 was completed in 1911. The construction of a new intake is contemplated for 1912.

Portsmouth—J. F. Witmer, Buffalo, N. Y., has been retained to prepare plans and superintend the construction of a water works plant. Estimated cost, $300,000.

Ravenna—The construction of a pump and boiler house and the installation of 1 3,000,000-gal. pump and 150-h.p. boiler is contemplated for 1912.

Sandusky—Extensive repairs to the filtration plant are contemplated for 1912.

Toledo—A 60,000,000-gal. clear water basin, additional pumping units, filters and a high pressure main system were constructed during 1911.

West Carrolton—A reservoir and dam were constructed in 1911.

Youngstown—An addition to the filter plant on Northwest ave. is to be built during the coming summer.

OKLAHOMA.

Ainsworth—A $21,000 bond issue for water works construction has been voted.

Altus—The following water works construction was completed in 1911: steel standpipe, $7,000; pump house, $1,000; 2 1,000,000-gal. pumps; 2 40-h.p. motors; and 2 wells 28 ft. in diameter and 28 ft. deep. For 1912 the following work is contemplated: Dam to cost $7,000; reservoir to cost $1,000 and a 9-mile canal.

Alva—the following water works improvements were completed during 1911: 1 66,000-gal. reservoir, 1 300,000-gal. and 1 65,000-gal. steel standpipe, 5 triplex pumps and 2 wells.

Chandler—Wells costing $2,500 were constructed during 1911. During 1912 a deep well costing $10,000 and deep well pumps will be purchased.

Clinton—The city will purchase 1 air compressor and will construct a deep well during 1912.

Durant—A filter plant, settling basins and wells costing $18,000 were constructed during 1911.

El Reno—Three reservoirs, a dam, pumping station and filtration plant were constructed during 1911.

Kenefic—A $15,000 bond issue for water works improvements has been voted.

Muskogee—The city is now constructing improvements which will cost $650,000, including a reservoir at the cost of about $49,000, a tunnel across the Arkansas River at the expenditure of $90,000, a purification plant and settling basin, also various new pipe lines from 24-in. down.

Prior Creek—The Benham Engineering Co., Oklahoma City, Okla., is preparing plans for the construction of a new water works system.

OREGON.

Cornelius—A $27,000 bond issue for the purpose of constructing a gravity water system from Rhoderick Creek including 5 miles of pipe line, is contemplated.

Portland—The following improvements were made during 1911: 125,000,000-gal. reservoir, 200,000-gal. standpipe, 10 miles of 52-in. and 14 miles of 44-in. conduits with a capacity of 45,000,000 gal.

Union—Water works extensions to cost $20,000 are contemplated. Wood or steel pipe will be used.

PENNSYLVANIA.

Bellwood—City constructed a reservoir in 1911.

Bradford—The work of enlarging the reservoir is in progress. Earth dam with core wall is under construction and will give a reservoir capacity of 200,000,000 gal. Estimated cost, $80,000.

Catasauqua—The following water works improvements were completed during 1911: a reservoir, 72 ft. in diameter and 15 ft. deep; a steel standpipe 15 x 80 ft.; a pumping station equipped with 2 pumps, 2 boilers and 2 air compressors.

Coatesville—Samuel Q. Dixon, state commissioner of health has ordered the installation of a filter and water sterilizing plant.

East Stroudsburg—The water works co. will drill an 8-in. well.

Erie—A sterilization plant was completed during 1911.

Franklin—A boiler and pump were purchased during 1911.

Ligonier—A concrete reservoir was constructed during 1911.

McKeesport—Leo Hudson, Haverstraw, N. Y., has prepared plans for water works extension.

Media—The Borough has purchased the property of the Nether Providence Water Co. at a cost of $10,050. Extensions are contemplated.

Port Alleghany—The reservoir was enlarged during 1911.

Phoenixville—The construction of a 3,000,000-gal. mechanical filtration plant is contemplated.

Somerset—A 500,000-gal. reservoir and pumping station were completed during 1911.

SOUTH CAROLINA.

Columbus—Water works extensions to cost about $15,000 are contemplated.

Orangeburg—An air compressor was added to the water works equipment during 1911.

Rock Hill—The water works system was rebuilt during 1911 at a cost of about $500,000.

SOUTH DAKOTA.

Aberdeen—Artesian wells costing $11,127 were constructed during 1911 and in 1912 the construction of 1 reservoir and 1 pumping station is contemplated.

Madison—The city will purchase 1 400 and 1 600-gal. per minute pumps.

Mitchell—The installation of a water softening plant is contemplated.

Pierre—A $5,000 addition to the pumping station was completed during 1911.

Sioux Falls—A concrete well 50 ft. in diameter, 30 ft. deep and costing $11,200 was completed in 1911.

Vermillion—The contract for the following construction was let in October, 1911: The plant which includes the following will be in operation about April 1st: a 100,000-gal. tank on a 110-ft. tower; 24 x 30 ft. brick and concrete pump house; 2 8¼ x 10 in. triplex Gould pumps: 2 40-h.p. Fairbanks-Morse oil engines with starting apparatus; 32 ft. x 15 ft. brick and concrete settling basin; and 2 65 ft. wells 10 ft. in diameter with 8-ft. Johnson screens.

Yankton—The purchase of a steel standpipe is contemplated for 1912.

TENNESSEE.

Clarksville—A complete water works plant costing $60,000 is now under construction.

Harriman—The city has purchased 2 200-h.p. internally fired boilers for the water and light plant.

Knoxville—A 12,000,000-gal. filtration plant was constructed in 1911.

TEXAS.

Belton—A 250,000-gal. reinforced standpipe was completed in 1911.

Cuero—Two wells were completed in 1911 and 2 will be constructed in 1912.

Dallas—J. H. Fuertes, New York City, is preparing plans for a 15,000,000-gal. water filtration plant.

Denison—A pumping station of 2,000,000-gal. capacity and 4 wells were completed in 1911. The construction of a filtration plant is contemplated for 1912.

Greenville—A 450,000-gal. reservoir was completed in 1911.

Houston—The installation of a water purification plant to cost about $200,000 is contemplated.

Sherman—Extensions to the water works system are contemplated.

Terrell—The construction of a reservoir and the drilling of new wells is contemplated.

Texas City—A reservoir and dam were constructed in 1911.

UTAH.

American Fork—A reservoir and dam were constructed during 1911.

Ogden—A filtration plant was constructed during 1911.

Provo—Concrete condult 18,193 ft. in length and costing $31,831 was constructed during 1911. A concrete swimming pool 60 x 30 x 7 ft. will be constructed during 1912.

VERMONT.

St. Albans—The construction of an earthen reservoir of 128,000,000-gal. capacity is contemplated for 1912.

VIRGINIA.

Gordonville—A $10,000 bond issue for water works construction has been voted.

Richmond—Water works extensions to cost about $70,000 are contemplated by the city of Richmond.

WASHINGTON.

Centralia—Frank C. Kelsey has been retained to prepare plans and estimates for the construction of 14.2 miles of 16-in. pipe line to deliver 3,000,000 gal. per day and cost about $112,115.

Grand View—W. H. Dunbar, city engineer, has prepared plans for water works extension to cost about $18,000.

Kent—A construction of a reservoir to cost about $2,000 is contemplated.

Seattle—The following water works construction was completed during 1911, lining reservoirs with concrete, $292,218; steel water tower, $14,880; gatehouse, $7,375; pumping station, $14,256.

Spokane—The following water works construction was completed in 1911: 4 350,000-gal. concrete standpipes; the Lincoln Heights pumping station; 1 3,000,000-gal. and 1 12,500,000-gal. pumps; electric motors to drive the above mentioned pumps; 1 well, 26 ft. in diameter and 40 ft. deep. During 1912 a 20,000,000-gal. reservoir with earth banks concrete lined, will be constructed; 200 ft. of tunnel will be built; meter testing apparatus and a 100-cu. ft. air compressor will be purchased.

Spokane—A 12,500,000-gal. pumping station and 2 standpipes were completed during 1911. The construction of a 28-in. force main to cost $130,000 is contemplated for 1912.

Walla Walla—A concrete reservoir 300 ft. x 400 ft. 20 ft. deep and costing $80,000 was completed in 1911. The purchase of 3,500 ft. of steel pipe for water mains is contemplated for 1912.

WEST VIRGINIA.

Fairmont—A pumping station was constructed in 1911.

Milton—A $10,500 bond issue for water works construction has been voted.

Parkersburg—A construction of a concrete reservoir is contemplated.

Romney—A 150,000-gal. reservoir and pumping station were completed in 1911.

Sistersville—The city completed a fireproof buff brick water station costing $4,500.

WISCONSIN.

Antigo—Additional pumping units were purchased during 1911.

Appleton—The installation of a filtration plant is being discussed.

Burlington—A concrete retaining wall around the standpipe was constructed.

LaCrosse—The construction of a water plant including about 3 miles of mains at an estimated cost of about $300,000, is contemplated.

Milwaukee—A 12,000,000-gal. pumping unit was installed.

WYOMING.

Cheyenne—The following water works construction was completed in 1911: 4 diversion dams, $55,700; 2 storage reservoirs, $166,000; and 2 concrete reservoirs, $30.000.

Greybull—Completed 4 mi. c. i. pipe line, tower and tank in 1911.

ELECTRIC LIGHT IMPROVEMENTS.

The following table gives a summary of the reports of additions to electric lighting plants made in 1911 and to be made in 1912. The first column gives the number of feet of street wiring done or proposed, the second the number of poles, the third the number of feet of underground conduits and the fourth the number of street lamps.

As nearly as may be, the kind of street lamps is explained in a note under each town installing them. The number of kinds of lamps is now so great that this information is in general only as to class of lamp, and not always so definite as that.

ALABAMA.

Sheffield—The electric lighting plant owned by a private corporation includes 1 building, 3 engines, 5 boilers and 2 generators.

ARKANSAS.

Pine Bluff—The city installed a 108-light tungsten lighting system in the business district.

CALIFORNIA.

Alhambra—An ornamental lighting system with concrete mission and Moorish standards has been completed on 7 streets. Lights spaced 100 ft. apart and 48 watts tungstens are used. Length of wire in system is 18,700 feet.

Lodi—The city installed 20 ornamental lights in 1911.

Salida—An ornamental lighting system with 14 standards was completed in 1911.

CONNECTICUT.

Hartford—The city is lighted by contract and the system includes at present 580 magnetite and 1,500 125-watt tungstens.

Waterbury—The city installed 73 arc lights and 19 incandescents in 1911.

DISTRICT OF COLUMBIA.

Washington—New lamps were established during fiscal year ending in 1911 as follows: 2,090 incandescents of 40 to 100 c.p., 47 arcs. wear comes directly on them and the sand or special fittings for putting the frames to- or ten or fifty of them on a moment's notice. swers call. The operation of all patrol boxes it at switchboard or not.

FLORIDA.

Gainesville—A $50,000 bond issue for a municipal light plant has been voted.

Jacksonville—A lighting system is now being constructed and it will include the following: 8 miles of wire, 450 poles, 12,000 ft. of conduit and 200 street lamps.

GEORGIA.

Cuthbert—A generator, an engine and 2 boilers were installed in 1911.

Waynesboro—The city installed 30 lighting poles and 12 lights in 1911 and will add 30 poles and some lights in 1912.

IDAHO.

Rexburg—A lighting system was completed in 1911 and includes the following: 26,000 ft. of wire, 200 poles, 12,000 ft. of conduits, 29 100-watt and 140 40-watt tungstens.

ILLINOIS.

Champaign—Contract for constructing a new street lighting system of the ornamental type, to James R. Cravath, $35,000.

Mattoon—The city purchased 1 generator and 70 magnetite arc lights for the municipal lighting plant during 1911.

Oak Park—The city purchased 19 arc lights in 1911.

Pekin—The Citizens Gas and Electric Co. will purchase several thousand ft. of wire in 1912.

Rochelle—One 150-k.w. generator will be purchased in 1912.

Streator—The question of constructing a municipal lighting plant to cost about $51,000 is being agitated. A bond election has been called.

INDIANA.

Clinton—One arc light and 3 incandescent units were installed in 1911.

Columbia City—The city extended its lighting system by 10,000 ft. of wire, 100 poles, 75 arc lights, 500 incandescents, 200 tungstens, 1 engine and 2 generators in 1911. The purchase of 5,000 ft. of wire, 100 poles, 500 tungstens, and the construction of 5,000 ft. of conduit is contemplated for 1912.

Ft. Wayne—The following improvements were completed in 1911: 239,860 ft. of wire, 415 poles, 10,000 ft. of conduit, 590 arc lights, 50 tungstens, 90 5-light ornamental posts, 1 building, 3 engines, 4 boilers and 3 generators. The following improvements are contemplated for 1912: 250,000 ft. of wire, 400 poles, 500 ft. of conduit, 50 arc lights, 25 tungstens, 500 ornamental posts, a new power station and 2 boilers.

Garrett—A steam engine driven generator will be installed about July 1st.

Indianapolis—The city installed 96 arc lights and 165 tungstens in 1911.

Linton—One Allis-Chalmers engine and generator unit was installed in 1911.

Logansport—Arc lights and a distribution system costing $2,800, a building at $12,300 and boilers at $13,575 were completed in 1911.

Portland—The city completed the following improvements in 1911: 7 miles of wire, 70 poles, 2 arc lights, 2 tungstens and 1 ornamental standard. In 1912 10 miles of wire, 100 poles, 12 arcs and 12 tungstens will be purchased.

Richmond—The installation of an ornamental lighting system is contemplated.

Seymour—The following additions were completed in 1911: 19 arc lights, 300 tungstens, 2 ornamental standards, 2 engines, 2 boilers and 2 generators.

IOWA.

Fairfield—An ornamental lighting system including 125 Mazda lamps, 20 poles, and 10,000 ft. of wire was completed in 1911. Lighting extensions as follows have been contracted for: 175 Mazda lamps, 100 poles and 20,000 ft. of wire.

Manchester—The city installed a 5-light ornamental lighting system including 30 standards and 1,800 ft. of wire.

Marshalltown—A franchise has been granted to Tubbs and Hamer, for lighting the streets with electricity.

Shenandoah—The contract has been let for installing 25 arcs and 160 tungstens.

Waterloo—An ornamental lighting system including 135 poles and 675 tungstens was installed in 1911.

Webster City—A new $40,000 municipal lighting plant was completed in 1911.

Woodward—The Woodward Heat & Lighting Co. has been incorporated for $10,000.

KANSAS.

Ottawa—Thirty street lamps were installed in 1911, 25 are now being put in place and 25 will be added in 1912.

Salina—A private lighting corporation installed 50 arc lights in 1911.

KENTUCKY.

Paris—The construction of a municipal lighting plant is contemplated.

MAINE.

Skowhegan—One arc light and 2 incandescent units will be purchased in 1912.

MARYLAND.

Baltimore—The installation of an ornamental lighting system in the downtown district is contemplated.

Cumberland—The Merchants and Mfgrs. Assn. proposes to convert the water works system power plant into a municipal lighting plant.

Myersville—The construction of an electric light plant is contemplated.

MICHIGAN.

Cadillac—The following improvements were added in 1911: 75 poles, 90 arc lights and 5 incandescents. The following is contemplated for 1912: A 200-k. w. generator, 100 poles, 10 arc lights and 50 incandescents.

Dowagiac—A lighting system was completed in 1911 and includes the following: 5 miles of No. 8 wire, 200 poles, 300 Fostoria lamps, and 150 center suspension tungstens.

Fenton—The construction of a municipal lighting plant is contemplated.

Kalamazoo—The city will vote on a $140,000 bond issue to remodel a municipal lighting plant.

Monroe—During 1911 40 poles and 3,500 ft. of wire were added to the distribution system, and in 1912 50 poles and 3,000 ft. of wire will be needed. It is the intention to purchase a boiler during 1912.

St. Johns—A 3-phase generator was purchased in 1911, and in 1912 20 5-arc light ornamental standards will be installed.

St. Joseph—The city purchased 30 arc lamps in 1911.

Ypsilanti—The following improvements were installed in 1911: 2,300 ft. of wire, 100 poles and 25 lamps.

MINNESOTA.

Eveleth—The city installed 15 arc lamps and 51 ornamental posts in 1911.

Fairmont—The present lighting system includes 2 engines, 3 generators and a distribution system of 80 poles, 70,000 ft. of wire and 1,200 tungstens.

Two Harbors—Two boilers were purchased for the combined electric light and water plant during 1911.

Valley City—The installation of an ornamental lighting system is being discussed by the Commercial club.

MISSISSIPPI.

Clarksdale—The following improvements were completed in 1911: 3,800 ft. of wire, 40 poles and 72 tungsten lamps. In 1912 60 tungsten lamps will be added.

MISSOURI.

Bethany—The city will purchase a boiler, 1¼ miles of wire and 175 poles.

Oregon—The city installed a 600-light ornamental lighting system in 1911.

MONTANA.

Billings—The city purchased 197 5-light ornamental lighting standards in 1911.

Chinook—The contract for constructing an ornamental light post has been awarded to the Two Miracle Co., of Kalispell, Mont.

Lewiston—The Lewistown power company has been incorporated for $200,000 to furnish the city with light and power.

NEBRASKA.

Alliance—The city extended its transmission line by 80 poles and 1 mile of wire in 1911.

Marquette—A $2,800 bond issue for electric light extensions has been voted.

Norfolk—The city will purchase 32 5-light ornamental standards and will construct 5,000 ft. of conduit in 1912.

Omaha—The installation of ornamental lights on the park boulevards is contemplated.

NEW HAMPSHIRE.

Littleton—Lighting extensions costing about $3,000 were constructed in 1811.

NEW JERSEY.

Camden—Chief Electrical Engineer John Kelly, Jr., and City Engineer Levi Farnham have been instructed to prepare plans for street lighting system which will include about 12,000 arc lamps and 2,500 incandescent lamps.

Jersey City—The present lighting system includes 1,806 arc lamps.

Ocean City—Lighting extensions as follows were completed in 1911: 10,000 ft. of wire, 100 poles, 50 arc lamps and 1,000 tungstens. In 1912 the city will purchase an engine and a generator, 500 incandescent lamps, 40 arcs, 50 poles and 12,000 ft. of wire.

NEW MEXICO.

Las Vegas—The city will purchase 100 tungsten lighting units in 1912.

NEW YORK.

Buffalo—The privately owned electric company completed the following extensions in 1911: 35,565 ft. of underground cable, 881,534 ft. of wire, 669 poles, 80216 ft. of conduit, 247 arcs and 37 ornamental lights.

Cortland—The city contemplates the construction of a conduit system in 1912.

Middletown—The installation of an ornamental lighting system is contemplated.

Niagara Falls—A merchants' committee has been appointed to arrange for extensions to the ornamental lighting system.

Solvay—Electric light extensions as follows were completed in 1911: 1 mile of wire, 100 poles and 50 street lamps. In 1912 25 street lamps, 40 poles and 3,000 ft. of wire will be added.

Syracuse—The present system includes 1,741 arc lamps and to this number 100 will be added in 1912.

Weedsport—The construction of a municipal electric lighting plant is contemplated.

Yonkers—The United Business Men's Assn. is agitating the question of ornamental street lighting.

NORTH CAROLINA.

Rocky Mount—The city added 4 arc lights, 60 poles and 20,000 ft. of wire to the system in 1911.

Statesville—The city extended the transmission line by 6,000 ft. of wire during 1911.

NORTH DAKOTA.

Jamestown—An entire new lighting system is to be installed in the place of an obsolete system. The work will be completed in 1912 and will cost about $20,000.

Valley City—The city extended the transmission line by 3,000 ft. of wire and 100 poles and installed 10 arc lamps and incandescents costing $1,200. In 1912 3,000 ft. of wire will be added and incandescents purchased to an amount of $1,200.

Williston—The transmission line was extended by 3,000 ft. of wire in 1911 and in 1912 an ornamental lighting system including 18,000 ft. of wire, 3,000 poles and 36 ornamental standards will be installed.

OHIO.

Bowling Green—The installation of an ornamental lighting system is contemplated.

Cincinnati—The installation of boulevard lights on Pike St., 12th St., Central Ave. and 4th Ave., is contemplated.

Dayton—The privately owned lighting corporation installed 800 arc lamps and 369 ornamental lighting standards in 1911.

Galion—The construction of an ornamental lighting system including 182 5-light standards and the addition of 100 arc lamps is contemplated.

Lucasville—The installation of an orna-

mental street lighting system is contemplated.

Mansfield—E. A. Merkel has prepared plans and estimates for a municipal electric lighting plant at Mansfield, O., including 200 ornamental lights. Estimated cost lighting system, $74,750; power house, $58,200.

Mineral Ridge—The installation of a municipal lighting plant is contemplated.

Newburgh City—A private lighting company furnishes 80 arc lamps under contract.

Salem—The Bailey Engineering Co., Alliance, O., has been retained to prepare plans for the tungsten street lighting system.

Springfield—Extensions to the lighting system are contemplated.

Youngstown—The installation of an ornamental lighting system in the downtown district is contemplated.

OKLAHOMA.

Altus—The present lighting system includes 30 miles of wire, 1,000 poles, 29 arc lamps and a power system, which includes 2 engines, 3 boilers and 2 generators direct connected. About 2 miles of wire and 75 poles will be added in 1912.

Clinton—The following extensions are contemplated for 1912: 2 miles of wire, 75 poles and 12 arcs.

Durant—The power for the 42 arc lamps which comprise the lighting system is furnished by 2 boilers, 2 engines and 2 generators. Extensions to cost about $5,000 are contemplated in 1912.

PENNSYLVANIA.

Conneautville—A franchise has been granted the Peoples Light Co., of Meadville, Pa., to furnish electricity for lighting purposes.

Duquesne—A council committee is investigating the question of ornamental street lights.

Media—The following improvements were constructed in 1911: 1 engine, 1 boiler, 1 generator, 98 arcs and 200 tungstens.

New Castle—The construction of a municipal lighting plant is being urged.

Pittsburg—The Allegheny County Light Co. has been given a contract for lighting the city for a period of 5 years.

Titusville—The installation of an ornamental lighting plant is contemplated.

RHODE ISLAND.

Cranston—The following improvements were completed in 1911: 2,000 ft. of wire, 15 poles and 20 incandescents. In 1912 2,000 ft. of wire, 20 poles and 20 incandescents will be purchased.

SOUTH CAROLINA.

Orangeburg—The lighting system includes the following: 1,000 ft. of wire, 50 poles and 22 tungstens and 1 engine and generator set direct connected.

SOUTH DAKOTA.

Mitchell—The installation of a 48-light tungsten system, including 6,700 ft. of galvanized conduit, is contemplated for 1912.

TEXAS.

Beaumont—The Beaumont Electric Light & Power Co. will construct an ornamental lighting system on Pearl St.

Hearne—An entire new electric light plant will be constructed in 1912.

UTAH.

American Fork—The present lighting system includes 100 street lamps.

Provo—The city paid $2,817 in 1911 for 207 32-candle power lamps. The construction of a municipal lighting plant is being agitated.

WASHINGTON.

Ellensburg—The contract for erecting 124 cluster lights has been awarded to Evans Dickson and Co., Tacoma, Wash.

Port Angeles—The city is contemplating the purchase of 180,000 ft. of wire, 300 poles, 10 arc lights and 250 incandescents. The current is supplied by the Olympic Power Co.

WEST VIRGINIA.

Parkersburg—The installation of an ornamental lighting system on a number of streets is contemplated. Light is furnished by a private corporation.

WYOMING.

Cowley—Will build three miles of pole line in 1912.

CANADA.

Vancouver, B. C.—The installation of 200 additional arc lights and a large number of ornamental lights is contemplated.

Winnipeg, Man.—The J. P. Morgan interests, New York, N. Y., have purchased the Winnipeg Street Railway line and the light, heat and power plant for the sum of $30,000,000. The purchasers announce that $15,000,000 will be expended in extensions.

GAS LIGHTING IMPROVEMENTS.

ALABAMA.

Talladega—The city purchased 5,000 ft. of 4-in. cast iron pipe in 1911 and will purchase 2,000 ft. in 1912.

ARKANSAS.

Pine Bluff—The present gas lighting system includes the following: 1 high pressure and 3 low pressure stations, 66,997 ft. of 4-in., 4,400 ft. of 3-in., 31,630 ft. of 6-in., 7,000 ft. of 10-in., and 3,400 ft. of 12-in. main and 20,000 ft. of service pipe.

INDIANA.

Indianapolis—The city installed 13 gas lamps in 1911.

IOWA.

Carroll—The city will construct a gas plant including about 5 miles of distribution mains.

Newton—The city constructed a new gas plant, including 1¼ miles of mains during 1911.

MICHIGAN.

Cadillac—The city constructed the following gas plant improvements during 1911: 1,063 ft. of pipe, 3 lamps, 3,339 ft. of services and plant additions costing $1,200.

MONTANA.

Billings—The city will construct 5 miles of gas mains during 1912.

NEW JERSEY.

Ocean City—The city constructed 5,000 ft. of gas mains in 1911 and wil construct 12,000 ft. in 1912.

NEW YORK.

Buffalo—The privately owned gas company constructed 22.25 miles of natural gas mains and 4.78 miles of artificial gas main and installed 554 lamps during 1911.

Solvay—About 4 miles of gas mains were constructed in 1911 and 2 miles will be completed in 1912.

OHIO.

Dayton—The Dayton Gas Co. operates the gas plant and will install 1,646 incandescent lights as needed.

GARBAGE COLLECTION AND DISPOSAL.

ALABAMA.

Sheffield—Garbage is dumped on the common, and the collection system comprises 2 horse-drawn wagons and 50 cans.

ARIZONA.

Jerome—The collection system includes 1 wagon and 2 horses and the garbage is dumped.

Pine Bluff—The city purchased the following for the garbage department during 1911: 7 wagons, 3 horses and 30 cans; and they will purchase 12 wagons, 6 horses and 24 cans during 1912.

CALIFORNIA.

Alameda—The garbage is hauled by wagons and dumped on a salt marsh 2 miles south of the city.

CONNECTICUT.

Hartford—The garbage is disposed of by contract.

Waterbury—During 1911 the garbage was fed to hogs. Contract has been given for collection and disposal.

GEORGIA.

Columbus—The city purchased 12 garbage carts, 12 mules, and 200 tin cans during 1911.

Rome—The city will purchase 6 garbage carts during 1912.

ILLINOIS.

Freeport—The present garbage disposal system includes 3 wagons, and 8 horses. The garbage is dumped upon the ground.

INDIANA.

Ft. Wayne—The city purchased 10 garbage wagons and 24 horses during 1911, and constructed a disposal plant. In 1912 2 wagons and 30 horses will be purchased and an addition to the disposal plant will be built.

Indianapolis—A contract for the disposal of garbage for a period of 6 years from 1911 was let for $48,000 per year.

New Albany—The city purchased 2 garbage dump wagons during 1911.

Seymour—One garbage wagon is operated by the city and 1 by contract for the disposal of refuse.

IOWA.

Iowa City—The city hauls the garbage in 2 wagons and disposes of it by feeding.

Newton—The city purchased 20 garbage cans in 1911.

KANSAS.

Ottawa—The city will construct an incinerator plant and will purchase 2 garbage wagons and 3,000 cans in 1912.

KENTUCKY.

Dayton—The city purchased 3 garbage carts and 6 horses in 1911, and will purchase the same in 1912.

Lexington—The city crematory is operated by contract at $11,000 per year. During 1911 6 wagons and 9 horses were purchased and a like number will be purchased in 1912.

MASSACHUSETTS.

East Hampton—The garbage is disposed of by contract.

Newton—Bids are now being received for disposal of garbage by contract.

Springfield—The garbage collection system includes 10 wagons, 8 sleighs, 14 horses and 2 mules.

MICHIGAN.

Menominee—The garbage is disposed of by dumping upon the ground.

MINNESOTA.

Mankato—Garbage is collected by 1 wagon and is dumped upon the ground.

Red Wing—The collection and disposal is made by contract.

MISSISSIPPI.

Clarksdale—The garbage collection system includes 1 wagon, 1 cart and 3 horses.

Greenville—The garbage is hauled and dumped into the river. A garbage scow was constructed in 1911 at a cost of $2,500.

Jackson—The garbage disposal system includes 1 incinerator, 10 wagons and 15 horses.

MISSOURI.

Kansas City—Garbage is disposed of by contract.

MONTANA.

Billings—The garbage collection system consists of 3 wagons and 7 horses.

NEW HAMPSHIRE.

Laconia—Garbage is collected by 2 horse-drawn wagons and hauled to a public dump.

NEW JERSEY.

Ocean City—The city purchased 3 garbage wagons and 6 horses in 1911 and will purchase 2 wagons and 4 horses in 1912.

NEW YORK.

Buffalo—The disposal of garbage and ashes is by contract. The city maintains a Heenan-Froude furnace, which was completed before 1911, and additional furnace was built in 1911, and in 1912 an elevated entrance, storage bins, picking belts and mixing floors will be completed.

Syracuse—A reducing plant was constructed, 15 wagons and 36 cans were purchased in 1911.

NORTH CAROLINA.

Greenville—The city will purchase 2 garbage wagons or carts and 50 cans in 1912.

Rocky Mount—The city purchased 4 garbage carts and 4 mules in 1911.

Statesville—The city purchased 1 garbage wagon and 2 horses in 1912.

NORTH DAKOTA.

The garbage is hauled in two wagons and dumped upon the ground.

OHIO.

Bucyrus—The city purchased 2 garbage wagons and 4 horses in 1911.

Dayton—The city constructed a disposal plant and purchased 15 garbage wagons in 1911.

Greenville—The city purchased 2 garbage carts in 1911.

Newburgh City—The garbage is hauled by 1 wagon to a garbage plant at Cleveland, O.

OKLAHOMA.

Durant—The city expects to install an incinerating plant.

Frederick—The construction of a garbage incinerator is contemplated.

Muskogee—A garbage plant was erected in 1911 at a cost of $21,000, which, with horses, wagons, etc., amounted to $30,000.

OREGON.

The sum of $75,000 has been appropriated for a collection system, which will be put in operation early in 1912.

PENNSYLVANIA.

Bradford—A garbage collection system is in prospect.

Erie—A disposal plant will be built and outfit of horses, wagons, cans, etc., for municipal collection, in 1912.

Media—The garbage is disposed of by contract.

Swissvale—A contract has been let for the disposal of garbage to the American Reduction Co., at $360 per month.

Westchester—The garbage collection system includes 3 horses and 3 carts.

RHODE ISLAND.

Cranston—The garbage is collected in 4 carts and is fed to swine.

SOUTH DAKOTA.

Hot Springs—A garbage collection system was introduced in 1911 and several additions are planned for 1912.

TENNESSEE.

Columbia—The garbage collection system includes 2 wagons, 3 carts and 7 mules.

UTAH.

Provo City—Garbage is collected in 1 wagon and hauled to a public dump.

WEST VIRGINIA.

Parkersburg—Garbage is disposed of by contract.

WISCONSIN.

Janesville—Garbage is disposed of by private contract.

Superior—The garbage collection system includes 4 wagons, 8 horses and 200 cans.

STREET SIGNS.

CALIFORNIA.

Alameda—The city uses the lettered lamp post street sign.

Jackson—The city purchased street signs at a cost of $100 in 1911.

CONNECTICUT.

Ansonia—The city purchased 300 enamel street signs in 1911 and will purchase 100 in 1912.

Hartford—All metal signs are being renewed.

Southington—The city has ordered 100 enamel signs.

IDAHO.

Boise City—The city will purchase 175 wood street signs in 1912.

ILLINOIS.

Canton—The city purchased 200 enamel street signs in 1911.

Freeport—A system of metal street signs has been recently installed.

Peoria—The sum of $250 has been appropriated for the purchase of street signs.

INDIANA.

Ft. Wayne—The city purchased 10,000 enamel and 3,000 sidewalk signs in 1911, and will purchase 6,000 enamel and 1,000 sidewalk signs in 1912.

Ligonier—The city purchased 200 enamel signs in 1911.

Seymour—The city purchased 300 metal signs in 1911.

IOWA.

Carroll—The purchase of metal street signs is contemplated.

Webster City—Wooden signs were installed throughout the city during 1911.

KANSAS.

Ottawa—The city purchased 60 sidewalk signs in 1911 and in 1912 will purchase 1,200 enamel signs and 50 sidewalk signs.

KENTUCKY.

Lexington—The system of street signs includes enamel markers for houses and posts and metal signs in the sidewalks.

MAINE.

Skowhegan—The city will purchase 100 wooden signs in 1912.

MARYLAND.

Brunswick—The purchase of street signs is being discussed.

MASSACHUSETTS.

North Attleboro—The 'system includes a number of wooden signs which are repainted each year.

Springfield—Approximately 200 enamel signs were purchased in 1911, and 1,000 will be needed in 1912.

Westfield—The city purchased 50 enamel signs in 1911.

MICHIGAN.

Menominee—The street names are stamped in the cement sidewalks.

Monroe—The city will purchase 450 wood signs in 1912.

MISSISSIPPI.

Jackson—The present system includes 400 enamel signs and 50 tile signs.

MISSOURI.

Kansas City—All street signs are placed in the sidewalks.

NEW HAMPSHIRE.

Laconia—The city purchased 50 wood signs in 1911 and will need 100 in 1912.

NEW JERSEY.

Ocean City—The city purchased 50 metal signs in 1911 and will purchase 20 in 1912.

Trenton—The city will purchase 1,000 enamel signs in 1912.

NEW YORK.

Auburn—About 60 wood and 80 metal signs were purchased in 1911 and 50 wood signs will be needed in 1912.

Buffalo—The city installed 57 enamel signs and 128 cast iron plate signs in 1911 and will purchase 50 enamel and 100 cast iron signs in 1912.

Plattsburg—About 200 enamel signs were installed in 1911.

Syracuse—About 5,000 enamel and metal signs were purchased in 1911.

NORTH CAROLINA.

Greenville—The city will need 200 street signs, kind not stated, in 1912.

OHIO.

Canton—The city will purchase 5,000 cast iron sign posts in 1912.

Dayton—About 200 enamel signs were placed in 1911.

Fostoria—The city installed 550 enamel signs in 1911.

OKLAHOMA.

Bartlesville—The city purchased 50 metal signs in 1911.

Frederick—The installation of a complete system of street signs is contemplated.

PENNSYLVANIA.

Bradford—The city will purchase 200 enamel signs in 1912.

East Stroudsburg—The city purchased 100 enamel signs in 1911.

Media—The city purchased 500 enamel signs in 1911.

Miners Mills—The borough purchased 105 enamel signs in 1911.

Ridgway—The city purchased 300 enamel signs in 1911 and will need 50 of the same in 1912.

Swissvale—The street signs are placed on the light globes at all street intersections.

RHODE ISLAND.

Cranston—About 50 street signs were installed in 1911.

SOUTH DAKOTA.

Hot Springs—A complete system of street signs was placed in 1911.

TENNESSEE.

Maryville—The purchase of street signs for the entire city is contemplated.

TEXAS.

Terrell—About 25 enamel street signs will be needed in 1912.

WASHINGTON.

Bellingham—Street names put in concrete walks at all street intersections.

WISCONSIN.

Janesville—The city purchased 910 enamel signs in 1911.

FIRE DEPARTMENT IMPROVEMENTS.

ALABAMA.

Decatur—The city purchased 1 horse-drawn hose cart, 1 combination hose and ladder truck, and 1,500 ft. of hose during 1911.

Sheffield—The present fire department comprises 1 building, 2 hose carts, horse-drawn, 1 ladder truck, a Gamewell fire alarm system comprising 10 boxes and about 3,000 ft. of hose.

ARIZONA.

Jerome—The fire department equipment includes 3 buildings, 3 hand hose carts and 1 chemical cart and 3,000 ft. of hose.

ARKANSAS.

Fort Smith—The city constructed a fire station and purchased 2 engines, 1 combination chemical and hose wagon and 7,000 ft. of hose.

Helena—The city constructed a two-story brick building and bought 1 hose cart, 1 ladder truck and 2,500 feet of hose in 1911. It will purchase 2 horses and 1,000 feet of hose in 1912.

Pine Bluff—The city will purchase 1,000 ft. of hose and 3 horses.

CALIFORNIA.

Alameda—The fire department equipment includes 8 buildings, 8 hose carts, 2 automobile propelled.

Antioch—The city purchased a combination automobile fire engine during 1911.

San Mateo—The city completed 4 hose cart buildings, installed a high pressure fire system and purchased 1 automobile fire engine at a total cost of $26,000 during 1911.

COLORADO.

Golden—The city purchased 300 ft. of hose and 2 bell towers during 1911.

Salida—The city will purchase an automobile fire engine and a hose wagon and chemical combination during 1912.

CONNECTICUT.

Ansonia—The city constructed a fire hall and purchased a hose cart during 1911.

Hartford—During 1911 the city purchased 1 automobile hose cart and rebuilt 2 horse-drawn fire engines, purchased 2 horse-drawn ladder trucks and 1 chief's car. Extensions to the fire alarm system, including 5 boxes, 50,000 ft. of wire were purchased and 3,100 ft. of hose were contracted for. During 1912 the following equipment will be purchased: 3 automobile hose carts, 1 horse-drawn fire engine, 1 tractor-drawn fire engine, 2 chief's cars, 5,000 ft. of hose, 10 fire alarm boxes and 60,000 ft. of wire.

Simsbury—The installation and equipping of a fire station is contemplated.

Southington—The purchase of an automobile chemical engine is contemplated.

Waterbury—During 1911 an automobile fire engine, and automobile chief's car and 2,350 ft. of hose were purchased.

GEORGIA.

Americus—The city purchased an automobile combination chemical and hose wagon in 1911.

Columbus—During 1911 the following equipment was purchased: 1 automobile hose cart, 1 automobile fire engine and 1,000 ft. of hose. During 1912 the city will build a station and will purchase 1 automobile hose cart and 1,000 ft. of hose.

Rome—The city purchased an automobile fire engine in 1911 and will purchase another in 1912.

IDAHO.

Boise City—The city built 3 fire stations and purchased the following equipment during 1911: 1 fire alarm system, including 90,000 ft. of wire and 60 boxes, and 3,000 ft. of hose. In 1912 1 station will be built, and 10,000 ft. of wire, 6 boxes and 2,000 ft. of hose will be purchased.

Payette—The city will construct a station house, will purchase 1 ladder truck and 250 ft. of hose during 1912.

Rexburg—The city will purchase a complete fire alarm system during 1912.

ILLINOIS.

Belvidere—The purchase of a combination chemical and hook and ladder truck is contemplated.

Freeport—The city constructed 3 department buildings and purchased the following equipment during 1911: 3 host carts and 1 horse-drawn ladder truck.

Mattoon—The city will purchase 1,500 ft. of hose during 1912.

Morris—The city purchased 500 ft. of hose during 1911, and in 1912 will increase the police alarm system.

Oak Park—The city has appropriated $10,000 for buildings and equipment.

Paris—The city purchased 1 horse-drawn hose cart in 1911 and will purchase 1,000 ft. of hose in 1912.

Pekin—The city is contemplating the purchase of an automobile combination chemical and hose wagon.

Rochelle—The city purchased one combination chemical and hose wagon and 1,000 ft. of hose during 1911.

Waukegan—During 1911 the city purchased an automobile fire engine costing $4,500, 1,000 ft. of hose and erected a $17,000 fire station. A $20,000 fire station will be built in 1912.

INDIANA.

Clinton—The city purchased 500 ft. of hose in 1911.

Columbia City—The city purchased a ladder truck and 1,000 ft. of hose in 1911.

Covington—A chemical engine horse-drawn has been purchased.

Ft. Wayne—The present equipment of the fire department includes 8 hose carts, 16 horses, 8 fire engines with 17 horses, 3 ladder trucks with 7 horses, 2 supply wagons with 4 horses, 2 chemical engines, 1 automobile-drawn, a Gamewell fire alarm system and 13,000 ft. of hose, all housed in 8 department stations. During 1912 2 stations will be built, 1 automobile chemical engine and 1,000 ft. of hose will be purchased.

Logansport—The city purchased 1,000 ft. of hose in 1911.

Mishawaka—An automobile chemical engine costing $5,500 and 2,000 ft. of hose were purchased in 1911.

Muncie—Purchased 1,000 feet of hose in 1911.

New Albany—The city has constructed a new fire station and will need 1 horse-drawn hose wagon and a new reel house.

New Castle—The city constructed 1 fire station during 1911 and in 1912 will purchase an automobile hose cart.

Richmond—The city will purchase an automobile chemical engine, for which the contract has been let.

Seymour—The present fire system comprises 1 horse-drawn hose cart, 1 horse-drawn fire engine, 1 horse-drawn ladder truck, 1 horse-drawn chemical engine and a complete fire alarm system.

Whiting—The city will purchase an automobile ladder truck.

IOWA.

Cherokee—The city purchased 500 ft. of hose in 1911.

Decorah—The city purchased 600 ft. of hose in 1911.

Harlan—A horse-drawn chemical engine and 200 ft. of hose were purchased in 1911.

Iowa City—The present fire system which is housed in 2 buildings includes 2 hose carts, horse-drawn, 1 horse-drawn ladder truck, a 15-box fire alarm system, with 20,000 ft. of wire.

Manchester—The city has purchased 600 ft. of hose.

Sioux City—The purchase of an automobile fire engine is contemplated.

Waterloo—An automobile hose cart was purchased in 1911.

Winterset—A combination hose and ladder truck, horse-drawn, was purchased in 1911.

KANSAS.

Hutchinson—One automobile combination ladder truck and pumping engine and 2 automobile fire engines were purchased in 1911.

Ottawa—The city will purchase a combination hose and ladder truck and pumping engine apparatus and 500 ft. of hose in 1912.

Pittsburg—The city purchased 1,000 ft. of hose in 1911 and will duplicate the order in 1912.

Salina—The city has purchased a combination hose and ladder truck and an automobile ladder truck.

KENTUCKY.

Dayton—The following fire equipment was purchased during 1911: 1 horse-drawn hose cart, 1 ladder truck and extinguishers.

Pineville—The city will purchase 1,000 ft. of 4-in. hose.

LOUISIANA.

Monroe—The present fire system includes 2 stations, 1 automobile and 1 horse-drawn combination chemical engines. The installation of a fire alarm system is contemplated for 1912.

MAINE.

Skowhegan—The city will purchase 1,500 ft. of hose in 1912.

MASSACHUSETTS.

East Hampton—The fire alarm system was changed from a one to a four circuit system and 500 ft. of hose was purchased during 1911.

Lawrence—The fire system comprises the following: 9 stations, 4 horse-drawn hose carts, 4 horse-drawn fire engines, 4 horse-drawn ladder trucks, 9 supply wagons, two horse-drawn chemical engines, 2 wagon guns, 4 combination hose and chemical wagons, 1 water tower, 19,500 ft. of hose and a Gamewell fire alarm system, including 123 boxes, 38 miles of wire underground and 52 miles of wire overhead.

Westfield—An automobile combination chemical engine was purchased in 1911.

MICHIGAN.

Allegan City—Five hundred ft. of hose was purchased in 1911.

Jackson—One automobile chemical engine was purchased in 1911 and 2 will be purchased in 1912.

Menominee—The fire system which is contained in 3 station houses includes 3 hose carts, 1 fire engine, 1 ladder truck and 1 supply wagon, all horse-drawn, 2,000 ft. of hose, and a Gamewell fire alarm system including 68 boxes.

Monroe—The city purchased 1,500 ft. of hose in 1911 and will need 1,000 ft. in 1912.

Pontiac—One LaFrance automobile chemical engine and 1,000 ft. of hose were purchased in 1911.

Port Huron—One fire station was constructed and 500 ft. of hose was purchased in 1911. In 1912 an automobile hose cart and 500 ft. of hose will be needed.

MINNESOTA.

Albert Lea—Five hundred ft. of hose was purchased in 1911.

Cloquet—The city purchased a 50,000-gal. chemical wagon in 1911.

Eveleth—Contracts have been let for the installation of a 10-box fire alarm system and the purchase of 3,300 ft. of hose.

Faribault—The city purchased 500 ft. of hose in 1911.

MISSISSIPPI.

Greenville—The fire system includes 1 ladder truck, 1 chemical engine and 2,100 ft. of hose. Will purchase 1,500 ft. of fire hose and 600 ft. of chemical hose in 1912.

Jackson—The city possesses 4 brick fire stations and the following equipment: 2 hose carts, 2 fire engines, 2 ladder trucks, 2 combination hose and chemical wagons, all horse-drawn, 6,600 ft. of hose, 1 chief's buggy, and a fire alarm system of the Gamewell type, including 45 miles of wire and 32 boxes. The city will purchase an automobile combination hose and chemical wagon in 1912.

MISSOURI.

Bethany—About 600 ft. of hose was purchased in 1911.

Sedalia—The purchase of a chief's automobile is contemplated.

Webb City—A combination hose and chemical wagon, automobile propelled and costing $5,000 was purchased in 1911.

MONTANA.

Billings—A fire station costing $20,000 was built, an automobile hose cart, a Gamewell fire alarm system, and 1,000 ft. of hose were purchased in 1911.

NEBRASKA.

Lincoln—The city purchased an automobile fire engine, an automobile hose cart, and 3,000 ft. of hose in 1911.

South Omaha—Two buildings were constructed and 2 horse-drawn hose wagons were purchased in 1911.

NEW HAMPSHIRE.

Keene—The installation of a battery fire alarm system is contemplated.

Laconia—The fire system comprises 3 buildings, 3 hose carts, 1 fire engine, 3 ladder trucks, 1 supply wagon, and 2 chemical engines, all horse-drawn, and a Gamewell fire alarm system.

NEW JERSEY.

Egg Harbor City—The purchase of a horse-drawn chemical engine and the installation of a fire alarm system are contemplated.

Elizabeth—Two fire stations will be constructed and an automobile fire engine and an automobile ladder truck will be purchased in 1912.

Glen Ridge—The city purchased a combination chemical and hose apparatus, 770 ft. of hose and 2,000 ft. of wire during 1911. About 700 ft. of wire, 1 fire alarm box and 300 ft. of hose will be purchased in 1912.

Ocean City—The city purchased an automobile chemical engine and 2,000 ft. of hose in 1911, and the purchase of 2,000 ft. of hose and the extension of the fire alarm system is contemplated for 1912.

South Amboy—The purchase of a Seagrave combination hook and ladder truck is contemplated.

NEW MEXICO.

Las Vegas—About 1,000 ft. of hose was purchased in 1911.

NEW YORK.

Auburn—The following equipment was purchased in 1911: 1 automobile chemical wagon and 1 fire alarm box. The construction of a fire station, the purchase of 2 tractors and 2 fire alarm boxes is contemplated for 1912.

Binghamton—A combination automobile hose cart and a horse drawn aerial ladder truck was purchased in 1911.

Buffalo—A national police and fire alarm system including 20 miles of wire and 16 boxes was installed in 1911 and 6,000 ft. of hose were purchased. A fire station will be constructed and a combination pumping engine and chemical truck automobile propelled will be purchased.

Geneseo—The purchase of 900 ft. of hose is contemplated for 1912.

Little Falls—The city purchased 1,000 ft. of hose in 1911 and will purchase a like amount in 1912.

Plattsburg—The city purchased 2,000 ft. of hose in 1911 and will purchase 1,000 ft. in 1912.

Syracuse—One station was constructed, a fire alarm system installed and 2,500 ft. of hose was purchased in 1911. The purchase of 1 combination hose and chemical apparatus, automobile propelled, a chief's automobile and 2,000 ft. of hose and the erection of a fire station is contemplated for 1912.

Utica—A small fire station will be constructed in 1912.

NORTH CAROLINA.

Rocky Mount—The following apparatus was purchased in 1911: 2 horse-drawn hose carts, 1 horse-drawn fire engine, and 1 horse-drawn ladder truck. The installation of a 20-box fire alarm system with 10 miles of line is contemplated for 1912.

Statesville—A horse-drawn ladder truck costing $5,500 was purchased in 1911.

NORTH DAKOTA.

Grand Forks—A city hall building and fire station costing $80,000 has been completed.

OHIO.

Barberton—The city purchased 1 triple combination 90-h.p. Webb automobile fire engine, 2 combination hose and chemical engines, 5 Garle fire alarm boxes and 1,000 ft. of hose during 1911. The purchase of a triple combination automobile pumping engine 1½ miles of wire and 8 fire alarm boxes is contemplated for 1912.

Bucyrus—A chemical engine, automobile propelled, and 2 fire alarm boxes were purchased in 1911.

Canton—The city will purchase 2 or 3 automobile fire engines, 1 automobile fire truck, 1 automobile supply wagon, 1 automobile chemical engine and 7,800 ft. of hose and will construct a fire station during 1912.

Circleville—The purchase of an automobile combination pumping engine and hose wagon is contemplated.

Conneaut—The city will purchase a hose drying tower.

Dayton—The present fire system which is contained in 16 stations includes 3 hose carts, 9 fire engines, 5 ladder trucks, 3 supply wagons, 13 combination hose and chemical wagons, all horse-drawn, 32,000 ft. of hose and a Gamewell fire alarm system of 262 boxes, 81 miles of overhead and 24,900 ft. of underground wire. The city will construct a fire station and will purchase 3 automobile combination hose and chemical wagons and a chief's automobile during 1912.

Galion—The purchase of 500 ft. of hose is contemplated.

Lorain—An automobile hose cart, an automobile ladder truck, and 3,000 ft. of hose were purchased during 1911 and a fire station costing $40,000 was erected.

Marion—The city will construct a central fire station and will purchase 2 automobile hose wagons in 1912.

Newburgh City—The fire system includes 1 hose cart and 1,100 ft. of hose.

Piqua—The purchase of 1,000 ft. of hose is contemplated.

Sandusky—The construction of a fire station is contemplated.

Wapakoneta—The city purchased 500 ft. of hose in 1911.

OKLAHOMA.

Altus—The city purchased an automobile combination hose cart in 1911.

Alva—A fire station was constructed and the following equipment was purchased: 2 hose carts and 1 combination hose and chemical engine horse-drawn, and 2,000 ft. of hose.

Bartlesville—A fire station was constructed and the following equipment purchased during 1911: 1 automobile hose cart, 1 hose cart, 1 fire engine, and 1 ladder truck, all horse-drawn, and 1 combination chemical engine, automobile propelled.

Chandler—The city will purchase 1,000 ft. of hose in 1912.

Clinton—The city will purchase an automobile hose cart in 1912.

Frederick—The city constructed a fire station and purchased 2,000 ft. of hose in 1911. The equipment comprises an automobile chemical engine and a horse-drawn hose cart.

OREGON.

Portland—Three stations were built and the following equipment was purchased during 1911: 2 combined chemical and hose wagons, automobile propelled, 1 automobile supply wagon, 2 automobile runabouts, a fire boat, 14,750 ft. of hose, 15 fire alarm boxes

and 34,300 ft. of wire. During 1912 7 stations will be built and the following apparatus purchased: 8 combined chemical and hose wagons, automobile propelled, 1 automobile fire engine, 1 automobile ladder truck, 1 supply wagon, 1 fire boat, 2 automobile runabouts, 16,100 ft. of hose, 60 fire alarm boxes and 58,100 ft. of wire.

PENNSYLVANIA.

Bradford—A brick fire station will be constructed in 1912 and an automobile chemical engine and 1,500 ft. of hose will be purchased.

Carlisle—The purchase of an automobile pumping engine or chemical wagon is contemplated for 1912.

Catasauqua—The fire system comprises 2 stations, 4 hose carts, 2 fire engines and 2 ladder trucks.

Claysville—The fire system comprises 1 hose cart and 800 ft. of hose.

Indiana—The construction of a municipal building and fire station combined, to cost $17,000, is contemplated. Contract will be let April 20.

Latrobe—The fire system which is contained in 6 stations includes 5 hand hose carts, 1 horse-drawn ladder truck and 1,500 ft. of hose.

Media—The fire system includes 1 station, 1 horse-drawn hose cart, 1 engine, 1 ladder truck, 1 chemical engine, all horse-drawn, and 500 ft. of hose.

Ridgway—The city will purchase a horse-drawn hose cart and 500 ft. of hose in 1912.

Sayre—The purchase of 500 ft. of hose is contemplated.

Swissvale—The fire system includes 1 station, 3 hand hose carts, 1 horse-drawn hose cart, 1 horse-drawn ladder truck, 2,300 ft. of hose and a Gamewell fire alarm system of 14 boxes and 39,700 ft. of wire. The city will purchase an automobile hose cart in 1912.

Westchester—The city purchased 1,500 ft. of hose in 1911.

RHODE ISLAND.

Cranston—The city purchased 6 hose carts, 1 automobile propelled, 1 fire engine, 6 ladder trucks, 1 automobile propelled, 6 supply wagons, 5,000 ft. of hose, 25 fire alarm boxes and 5 miles of wire. The purchase of 2,000 ft. of hose is contemplated.

Woonsocket—A fire station to cost about $14,000 is contemplated.

SOUTH CAROLINA.

Orangeburg—One horse-drawn hose cart was purchased in 1911 and the purchase of an American LaFrance combination chemical engine and 1,000 ft. of hose is contemplated for 1912.

SOUTH DAKOTA.

Hot Springs—The fire system which is contained in 3 stations includes the following: 3 hose carts, 1 ladder truck and an 18-box fire alarm system with 3½ miles of wire.

Yankton—The city purchased 500 ft. of hose in 1911.

TENNESSEE.

Columbia—The fire equipment comprises 1 combination chemical and hose wagon.

TEXAS.

Cuero—The city purchased a fire alarm system costing $1,500 and 500 ft. of hose. The purchase of 1,000 ft. of hose and 2 automobile hose carts, for which the contracts have been let, is contemplated for 1912.

Terrell—The purchase of an automobile fire engine to cost about $7,500 is contemplated.

UTAH.

Provo City—One horse-drawn hose cart was purchased in 1911.

VERMONT.

Enosburg Falls—The fire system comprises 4 hose carts and 2,000 ft. of hose.

St. Albans—The city purchased a horse-drawn ladder truck in 1911 and will purchase 1,000 ft. of hose in 1912.

WASHINGTON.

Bellingham—The city installed a Gamewell system and bought 4,000 feet of hose in 1911. It will buy a combination auto truck in 1912.

Hoquiam—The fire system includes 3 buildings, 1 fire engine, 2 horse-drawn fire engines, 1 hand ladder truck, 3 horse-drawn combination chemical engines, 6,200 ft. of hose, and a Gamewell fire alarm system including 27 boxes and 15 miles of wire.

Port Angeles—The construction of a fire station and the purchase of the following equipment is contemplated for 1912: 1 horse drawn fire engine, one horse-drawn ladder truck, 2 automobile supply wagons, and 1,200 ft. of hose.

Spokane—One automobile hose cart, 2 horse-drawn fire engines, 1 automobile chemical engine, 1 chief's auto, 3,000 ft. of hose, 25 fire alarm boxes and 10 miles of wire were purchased during 1911.

WEST VIRGINIA.

Moundsville—The city will purchase 1 automobile fire truck and 2 ladder trucks in 1912.

Parkersburg—2,000 ft. of hose was purchased in 1911.

WISCONSIN.

Ashland—One horse-drawn hose cart was purchased in 1911 and 2 horse-drawn hose carts and 1,000 ft. of hose will be needed in 1912.

DePere—The city purchased 500 ft. of hose in 1911 and will purchase 700 ft. in 1912.

Janesville—An automobile hose cart was purchased in 1911 and 6 fire alarm boxes will be needed in 1912.

Waupaca—The city purchased 1,000 ft. of hose during 1911.

WYOMING.

Cheyenne—The present fire system includes 2 stations, 2 horse-drawn hose wagons, 1 automobile combination chemical and hose wagon, 1 horse-drawn aerial truck, 2 30-gal. chemical engines and 1 45-gal. automobile chemical engine, 5,000 ft. of hose, 1 chief's buggy and a 36-box Gamewell fire alarm system with 6 miles of overhead wire and 4 miles of underground wire. In 1912 the city will construct a pumping station and will purchase 1 2-horse hose cart, 1 mile of wire, 3 fire alarm boxes, chief's automobile and 11 ft. of hose, the latter of which has been contracted for.

Progress in Good Roads.—Houston Public Improvement Law.

Recent Progress in the Good Roads Cause.

(Continued from Page 197, March Number.)

SOUTH CAROLINA.

The state of South Carolina at present has no laws giving the state any control over road construction, gives no state aid and has no state highway officials. The South Carolina Geological Survey, M. W. Twitchell, State Geologist, collects data regarding road work as opportunity offers, but has no duties in this respect and no special funds to pay expenses. The State Commissioner of Agriculture also collects some road statistics.

The state has 32,075 miles of road, although a detailed estimate of road mileage made in 1904 gave nearly 10,000 miles more length than the last report. Of the roads 3,535 miles, or 11.02 per cent have been improved, largely as sand-clay roads, of which there are 3,218 miles. Of the better surfaces there are 154 miles of macadam, 131 miles of gravel and 32 miles of shell roads.

The mileage of improved roads varies from zero in six counties to 450 in one, or from zero to 64.35 per cent of all the roads in the county. However, the county with the highest mileage of improved roads has but 2½ miles of macadam, all the rest being sand-clay. One county has 20 miles of macadam and 45 miles of gravel road in a total of 1,000 miles, and no other county has as many miles of the harder surface roads.

In the 23 counties reporting cost of building roads the average cost of sand-clay roads is computed as $415 a mile; of gravel roads $1,133 and of macadam roads $3,252, the latter average being brought up from about $2,500 a mile by the influence of one county, which reports a cost of $7,000 a mile for macadam roads. Another report states that sand-clay roads can be built 30 feet wide for $450 a mile and maintained by monthly attention from a gang of 5 convicts at about $10 a mile a year.

There are several county and district good roads associations and a state association which are agitating the issuance of county bonds for road building and a state highway organization. It is estimated that more than $1,000,000 will be spent on new road construction in the state during 1911.

In most of the counties of the state boards of three county commissioners have charge of the county roads. A few counties have boards which consist of the chairmen of the township boards. Each county has a supervisor. Each township in a county is a road district and a road overseer is appointed for each, who takes charge of the work on the roads.

South Carolina has a population of 1,515,400, which is increasing 10 or 15 per cent each decade. Its 43 counties range in population from 17,000 to 89,000.

SOUTH DAKOTA.

South Dakota has a highway commission appointed under the first state highway law, which was passed in 1911. The law carried no direct appropriation, but the commission has charge of the construction at state expense of certain roads on state lands. John Parmley, Ipswich, is the chairman of the commission and Samuel H. Lea, Pierre, is state engineer.

The state engineer has made a reconnaissance for the South Dakota part, from White Rock to Yankton, of what is called the Meridian road, which is to run from Winnipeg, Canada, to Galveston, Tex. The length of this part is 275 miles.

The state now has 56,354 miles of road, of which only 286 are improved, or 0.5 of one per cent. Of the improved roads 147 miles are gravel, 10 are macadam and 129 are sand-clay. One county has 75 miles of gravel road, which is 5 per cent of its total mileage. No other county has as much, and 50 counties have no improved roads.

County roads are in charge of boards of three county commissioners. Counties not divided into townships are divided into one or more road districts with a supervisor for each. County supervisors divide their townships into suitable road districts and appoint an overseer for each district.

South Dakota has a population of 583,888, which is increasing over 45 per cent per decade. Its 68 counties range in population from 100 to 30,000.

TENNESSEE.

Tennessee has no state road department and the state does not aid in road building. Many counties have bonded themselves heavily for good roads and there is at present a strong effort to complete a highway from end to end of the state, Memphis to Bristol, to be built by the counties through which it passes. A general specification for this road has been prepared. The engineer of Madison County has described the work in his county which results in a cost of $5,300 per mile, of which 75 per cent is the cost of the novaculite used, hauling, and putting it down, and the other 25 per cent is for grading and draining; and in sand-clay roads costing $1,500 a mile, and maintained with the road-drag at a cost of $5 a year. It is estimated that the counties of Tennessee will spend nearly $4,000,000 on new construction in 1912.

There are 45,913 miles of road in the state, of which 5,353.5 miles have been improved, or 11.66 per cent. Of the improved roads 2,684 miles are macadam, 2,542.5 miles are gravel and 127 miles are sand-clay. The mileage of improved roads varies from zero in 31 counties to 600 in one county or 24 per cent. Two counties have 55 and 58 per cent of their roads improved.

The average cost of macadam roads in the 24 counties reporting is $2,727 a mile; of gravel roads is $1,697, 16 counties reporting; and of sand-clay roads is $1.050, 3 counties reporting.

The county roads are in charge of the county court which appoints 3 superintendents, of which the chairman or judge is one, to see that turnpike and toll roads are maintained. The county is divided into districts and a road commissioner is appointed for each district who, in turn appoints an overseer for each 5 miles or less of road in his district.

Tennessee has a population of 2,184,789, which is increasing about 10 per cent per decade. Its 96 counties range in population from 3,000 to 191,000, all but four being below 42,000.

TEXAS.

Texas has no state road department and does not appropriate state funds in aid of road building. A number of counties in the more thickly settled districts have bonded themselves heavily for road construction in recent years. These bond issues have been from $150,000 to $1,600,000 per county, ten counties having voted $4,550,000 of bonds in 1911, and 49 counties having voted $8,915,000. Much of this amount is available for construction in 1912.

The state has 128,971 miles of road, of which 4,896 or 3.8 per cent have been improved. The improved roads consist of 365¼ miles of stone, 2,126 miles of gravel, 2,253¾ of sand-clay, 126 miles of shell and 25 miles of macadam with shell top.

The sand-clay roads are new within the past five years, and the gravel and broken stone roads have each increased about 200 miles in that time, and the shell roads about 100 miles. The stone roads are all in 10 counties and nearly all in four, those in which Beaumont, Austin, Taylor and Decatur are located. The shell roads are in six counties in the vicinity of Galveston, Houston and Corpus Christi.

One county has improved 54.11 per cent of its roads, nearly all with sand-clay and all those which have improved over 20 per cent of their roads have used sand-clay or gravel, according to local conditions, except Aransas county which has paved 10 miles of its 44 with shell, and Comal county which also has 20 miles of macadam.

The average cost of road construction in the counties reporting is $168 a mile for earth roads, $593 for sand-clay, $3,083 for shell, $1,708 for gravel and $2,160 for macadam.

The county roads are in charge of commissioners' courts of 4 members each. They divide their counties into road precincts and appoint an overseer for each.

Texas has a population of 3,896,542, which is increasing about 30 per cent per decade. Its 145 counties range in population from 65 to 136,000.

Houston's New Public Improvement Law.

The citizens of Houston have adopted an amendment to the city charter which opens the way to greatly improved conditions in the street paving of the city.

According to the terms of the amendment, whenever two-thirds of the owners of the front feet of property abutting on any highway, proposed to be improved, shall petition the city council to make improvements thereon, and designate the nature of the proposed improvements, and the limits within which they are to be constructed, the kind of pavement and the materials to be used, agreeing to pay the whole cost of constructing curbs (if any) and two-thirds of the cost of other improvements in front of the property of the owners abutting upon the highway to be improved, exclusive of the portion payable by the owners of railroads and street railways, the city council shall receive such petition and cause the same to be filed.

The petition shall remain on file with council not less than five days before the date fixed by it for acting upon the petition. On that date the city council shall consider the petition and hear any objections thereto which may be made by any owner of property abutting the improvement, or any party interested therein, and if the said petition is found to be in due form, and the owners of at least two-thirds of the front feet of property abutting upon the improvement have signed the same, the council shall, by resolution, order the making of such im-

provements, and the passage of such resolution shall be conclusive of the regularity and legality of such petition, and the public necessity and general benefit of such improvements.

The petitioners have the right to direct the construction of the kind of pavement specified in the petition, and of the other improvements described, and the use of the materials designated and to stipulate the maximum cost per cubic or square yard of improvements, or front foot of abutting property, at which the work of constructing the improvements shall be let, and no contract shall be let for a greater cost than is stipulated.

The council may only refuse to grant petition for the reason that there are no funds legally available out of which the city's portion of the cost of the proposed improvements can be appropriated.

Discharge of Ohio River.

In volume of water the Ohio river is the main tributary of the Mississippi. Its mean discharge, according to the records of the United States Geological Survey, is about 300,000 cubic feet per second, which is much more than the discharge of the St. Lawrence river at Ogdensburg, N. Y., although the drainage area of the St. Lawrence is nearly twice that of the Ohio. The maximum flow of the Ohio is approximately 1,500,000 cubic feet per second—about thirty times the low-water flow.

A comparison of records of flow of the Ohio river with those of the Upper Mississippi and Missouri shows that although its drainage area is but one-third that of the combined Mississippi and Missouri its mean and low-water flow is 1.3 times as great as their combined flow, and its maximum flow is 1.5 times as great. This fact is accounted for by the greater rainfall in the Ohio basin and by the general character of the region.

The Ohio basin affords many opportunities for storage, especially on the southern tributaries. From topographic maps of the Geological Survey covering part of the drainage area of the Ohio, a large number of reservoir sites have been located, some of them of enormous capacity. Careful surveys would undoubtedly show many suitable sites for dams that would impound large reservoirs.

Automobile Garbage Trucks in Cleveland.

To enable Director of Public Service Springborn to work out a new system of garbage collection which will require the establishment of four stations and the services of auto trucks for long hauls to the central station on Canal road, the council committees on finance and appropriations of Cleveland, O., have voted to allow the garbage department $150,000 instead of the $133,000 originally asked for. The establishment of the four suo-stations will reduce the present long haul, and the use of the automobile garbage trucks will greatly increase the efficiency of the collection service. Ten-ton automobile trucks, each drawing four trailers, will be used.

Vincennes' Rented Sewer System.

After months of re-arranging of contracts, the city council has at last arrived at a proper contract with the Vincennes Sewer Association for the construction of a complete sanitary sewer system. The contract specifies that the city pays an annual rental for twenty-five years. The cost will be near a half million dollars.

The Lighting of Dearborn Street, Chicago.

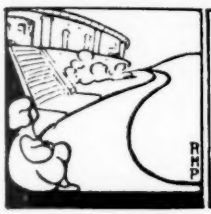
Plans of the Dearborn Street Improvement Association for an auxiliary lighting system that will increase the illumination of the street, between Lake and Polk streets, were announced recently by President John C. Roth. As was originally planned, the current for the new lighting system will be furnished by the Sanitary District.

Contracts for 100 brackets, each to support four Tungsten electric lamps of 200 watt power, have been let and the apparatus will be installed within the next two months. The cost is estimated at $10,000 and will be borne by business men and property owners of the thoroughfare in the downtown districts. The Chicago Railways Company has granted the use of its trolley poles, and the first 100 lamps will be supported by them by means of brackets.

Responsibility for the maintenance and support of the added lighting system, which will be independent of the regular city service, will fall upon the improvement association, although the officers hope to interest the city in a plan for sharing in the operating expenses. Plans for the new ligthing system have been under consideration by the improvement association for several months. Should the project prove a success other streets will be provided for similarly by the abutting property owners, it is predicted.

The Engineering Directory.

The 1912 "Engineering Directory," published by the Crawford Publishing Co., Chicago, Ill., is a complete directory of the plumbing, heating, power plant and mill supply industries in the United States. Among the lists a trifle outside the exact lines of the above description are those of the purchasing agents of the principal railways, the leading architects, the electric lighting and power plants, gas companies, water works companies and trade associations. The lists are thoroughly classified so that they are convenient for reference for any usual purpose. The price of the 1,500-page book is $5.



ORGANIZATIONS & INDIVIDUALS

Manitoba Good Roads.—Good Roads Year Book.—National Association of Cement Users.—Technical Associations.—Calendar.—Technical Schools.—D. D. Drummond.—Personal Notes.

Activity of the Manitoba Good Roads Association.

The Manitoba Good Roads Association has prepared a bill for the consideration of the legislature during the present session, which will be presented by a big delegation composed of the Good Roads Association, the Union of Manitoba Municipalities, the Winnipeg Automobile Club, the Winnipeg Motor Trades Association and other associations. One of the principal clauses of the bill is that which provides for the guarantee of municipal bonds for road work by the government. The government is prepared to set apart a sum of $200,000 for highway improvements during 1912, and in addition to make a grant equal to one-third of the total cost toward any permanent road work carried out by the municipalities.

The Good Roads Year Book.

Announcement is made of the forthcoming Good Roads Year Book, to be issued by American Association for Highway Improvement. The book will contain matter of interest to public road officials, contractors and engineers. The following are among the subjects covered.

A directory of international, national, interstate, state and local organizations which deal with the subject of road improvement, giving names of associations, the names, titles and addresses of their offcers and a brief statement of purposes.

All available information relating to appropriations by the national and state governments and by counties and townships for road improvement.

Information concerning bonds issued, authorized and contemplated by states and their subdivisions for road improvement.

A concise biography on roads.

A description of the types of bridges and culverts most in use, illustrated by drawings.

A list containing names and addresses of road contractors.

Dust preventives, definitions and methods.

A directory of national and state highway officials.

A list of educational institutions giving instruction in highway engineering and a condensed description of the courses given.

A condensed digest of the road laws of each state to January 1, 1912.

A table showing total mileage of all roads in each state and the mileage of improved roads of each type in the respecive states.

A short chapter on the various systems of maintenance now in effect.

A directory of manufacturers of road material and machinery, giving names, addresses and the kind of material or equipment manufactured.

A list of periodicals which devote attention to road improvement, with addresses, subscription price and name of publishers.

Brief definition of each type of road and methods of construction—bituminous macadam roads, brick roads, concrete roads, earth roads, gravel roads, macadam roads, sand clay roads, telford roads.

Further information may be obtained from the American Association for Highway Improvement, J. E. Pennybacker, Jr., Colorado Building, Washington, D. C.

The National Association of Cement Users.

The eighth annual convention of the National Association of Cement Users convened in Kansas City March 11 to 16.

Following the formal addresses of welcome and reply, Dr. W. M. Cross read the first technical paper on "The Use of Reinforced Concrete in Hypochlorite Water Purification Works." He was followed by George E. Tebbetts, engineer, Kansas City Terminal Railroad Co., who spoke on "The Use of Concrete in the New Union Station."

The session on Tuesday forenoon was devoted to the consideration of aggregates for concrete and to committee reports. W. M. Kinney, assistant inspecting engineer of the Universal Portland Cement Company, presented a paper entitled "Discussion on Aggregates for Concrete."

H. V. Schreiber, engineer, Sellers & Rippey, Philadelphia, then described and showed lantern slides of the design and construction

of a hollow reinforced concrete dam of the Portland Railway, Light and Power Company at Estacada, Ore., on the Clackamas river.

The annual address of President Richard L. Humphrey at this session was interesting, as showing the development of the application of concrete in Europe.

Wednesday forenoon tests on reinforced concrete buildings under load were described by Prof. Talbot and Mr. Slater, of the University of Illinois. The method of making the tests was described in detail. W. S. Gearhart, state highway engineer, Kansas, gave an illustrated talk on highway bridges in his state, calling special attention to the necessity for good foundations and the fallacy of believing cheap first cost meant a cheap bridge. A paper on Concrete Bridges was also presented by Daniel B. Luten, of Indianapolis.

Concrete pavements were discussed in papers by F. P. Wilson, city engineer, Mason City, Ia., and E. W. Groves, city engineer, Ann Arbor, Mich. Following these papers the proposed revised specifications on concrete road and street pavements were read by C. W. Boynton, chairman of the committee.

A very good paper on "The Manufacture and Use of Concrete Drain Tile" was presented by C. E. Sims, secretary of the Interstate Cement Tile Manufacturers' Association. Gustave Kaufman, chief engineer of the Wilson & Baillie Manufacturing Co., of Brooklyn, N. Y., presented a paper on the advantages and durability of cement sewer pipe, based on the application of this material in sewer building in Brooklyn.

At the business meeting on March 13 the following officers were elected: President, Richard L. Humphrey, of Philadelphia; first vice-president, E. D. Boyer, Catasaqua, Pa.; second vice-president, Professor A. N. Talbot, Urbana, Ill.; third vice-president, E. S. Larned, Boston, and fourth vice-president, Professor Ira H. Woolson, New York.

Technical Associations.

At a meeting in Burlington, Vt., March 7, the Association of Vermont Engineers was formed and the following officers elected: President, F. O. Sinclair, of Burlington; vice-presidents, D. Williams, of St. Johnsbury, and J. E. Helyar, of Brattleboro; secretary, G. A. Read, of Barre; treasurer, A. E. Winslow, of Norwich.

At the fifth annual meeting of the Highway Engineers' Association of Missouri, held in Kansas City March 13-14, the following officers were elected: President, L. M. Stallard, St. Joseph, Mo.; vice-president, Alfred Riske, St. Charles, Mo.; secretary, J. E. Warner; treasurer, P. S. Quinn.

The Pacific Association of Consulting Engineers was recently organized at San Francisco and the following officers were elected: President, A. L. Adams; vice-president, C. D. Marx; secretary-treasurer, C. Derleth, Jr., University of California, Berkeley, Cal.

The Wyoming Society of Civil Engineers was recently organized at Basin, Wyo., to raise the engineering standard of the state and to promote public confidence in the irrigation and development of the state. The following officers were elected: President, C. W. Atherly, Basin; vice-president, H. T. Nowell, Basin; secretary-treasurer, M. D. Woolery, Thermopolis.

The second annual New York Architecture and Engineering Exhibition, which was to be held from March 25th to 30th, has been merged with and will be held in conjunction with the Fire Exposition, October 2d to 12th, constituting a department of fireproof construction and safety building equipment.

On the invitation of His Majesty's Government it has been decided to hold the Third International Road Congress in London, England, in June, 1913, to continue the studies already undertaken regarding the construction and maintenance of roads and bridges in view of modern methods of locomotion. The leading foreign governments have intimated their intention of sending delegates, and it is anticipated that there will be a large attendance of the representatives of many local authorities, engineering and other societies, and of road users, both at home and abroad.

In accordance with the terms of a statement from the president of the United States which assigns to the secretary of the department of commerce and labor the duty to initiate a movement for the establishment of a national organization representative of the commercial interests of the whole country, by calling a meeting of representative commercial and industrial associations of the Nnited States for the purpose of considering the question and outlining the principles by which such an organization should be governed, a conference is to be held in Washington, D. C., on April 15, 1912.

Calendar of Technical Meetings.

National Drainage Congress. Annual meeting at New Orleans, La., April 10-13. Vice-president, E. T. Perkins, First National Bank Bldg., Chicago.

Tri-State Water and Light Association of the Carolinas and Georgia. Annual meeting Salisbury, N. C., April 16-17. J. W. Neave, secretary, Salisbury, N. C.

American Electrochemical Society. Annual meeting Boston, Mass., April 18-20. J. W. Richards, secretary, Lehigh University, South Bethlehem, Pa.

American Water Works Association. Annual convention Louisville, Ky., June 3-8. John M. Diven, secretary, 217 River st., Troy, N. Y.

Mayors Conference of New York. Third annual meeting Utica, June 10-12. Mayor C. C. Duryee, president, Schenectady, N. Y. C. C. Capes, secretary, New York.

Fire Marshals' Association of North America. Annual convention, Hotel Cadillac, Detroit, Mich., July 10-12. State Fire Marshal Palmer, president, Lansing, Mich.

National Municipal League. Annual meeting Los Angeles, Cal., July 8-12. Clinton Rogers Woodruff, North American Bldg., Philadelphia, Pa.

New York Fire Exposition and International Conference of Fire Prevention, Protection and Extinguishment. Seventy-first Regiment armory, New York City, October 2-12. A. D. V. Storey, secretary, 1269 Broadway, New York, N. Y.

Technical Schools.

The University of Illinois announces the second competition for the award of the Francis J. Flym fellowship in architecture. The value of the fellowship is $1,000. It provides for a year of travel in Europe for the study of architecture.

Bulletin No. 425 of the University of Wisconsin contains 192 pages of a discussion of "The Flow of Streams and the Factors That Modify It, with Special Reference to Wisconsin Conditions," by Prof. Daniel W. Mead of the chair of hydraulic and sanitary engineering, which is a notable and valuable contribution to the knowledge of facts and theories on this important subject.

Prof. W. K. Hatt, of Purdue University, delivered an exchange lecture before the students and faculty of the College of Engineering of the University of Illinois March 6 on "Timber Preservation." He also gave an address before the freshmen of the college on "Mountain Railways."

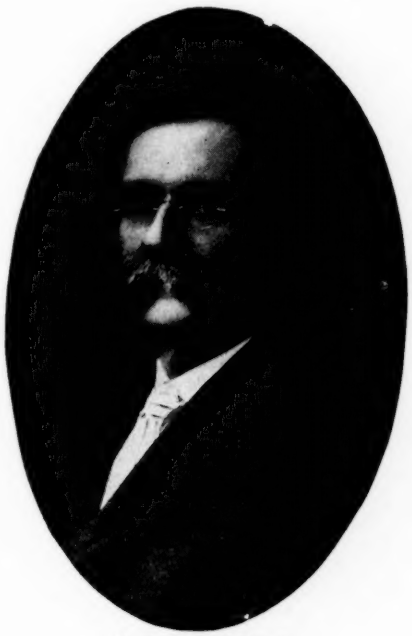
Among the special lectures which have been given before the highway department of Columbia University during March are the following: Sand-Clay Roads and Oil-Cement-Concrete Pavements, by Logan W. Page, director United States Office of Public Roads, Washington; Mixing Plants for Bituminous Pavements, by Francis P. Smith, chemical and consulting paving engineer, New York City; Comparison of Pavements, by George W. Tillson, consulting engineer to the president of the Borough of Brooklyn, New York City; The Construction and Maintenance of Park Roads, by John R. Rablin, Massachusetts Metropolitan Park Commission, Boston; The Organization of the State Highway Department of New York, by John A. Bensel, New York state engineer, Albany.

Dr. Henry Wilson Spangler, professor of mechanical engineering and head of the mechanical engineering department of the University of Pennsylvania for twenty years, died in Philadelphia on March 18. He was an officer of the United States navy at one time and was a consulting engineer of the United States government. Prof. Spangler graduated from the United States Naval Academy in 1878. After serving for eleven years in the navy he accepted a position as assistant professor of mechanical engineering in the University of Pennsylvania.

David D. Drummond.

David D. Drummond died at his home in Chicago on March 8. Mr. Drummond was one of the early cement manufacturers in the middle west, his connection with the Chicago Portland Cement Company, of which he was later vice-president and manager, dating back thirteen years.

Mr. Drummond was a prominent figure at the meetings of the Association of American Portland Cement Manufacturers and during his entire lifetime he was actively interested in the work of the National Association of Cement Users and kindred bodies.



D. D. DRUMMOND.

Mr. Drummond was born in Scotland, but lived in this country since boyhood. He died in his fifty-second year and is survived by a widow and three sons, Douglas, Ralph and Kenneth.

Motor Turntable Fire Escape.

The British Trade Journal contains a description of a motor turntable ladder truck, which is said to have given great satisfaction at its trial in a suburb of London.

The machine in question consists of a standard chassis, fitted with a 50 h.p. gasoline motor, carrying a ladder constructed in four sections, and arranged to lie in a horizontal position when traveling. The ladders can be raised to a vertical position or to any intermediate angle by means of hand winches. The fulcrum is at the rear of the chassis upon a base ring or turntable, which permits of the ladders being slewed round

to any desired position. They are extended telescopically to the required height by means of a small engine or by hand winches. The operation of lowering the ladders is controlled by the same engine, the cylinders of which act as air cushions in taking the weight. The lowering of the ladders can be arrested at any moment by closing a small cock. Additional stability is given to the machine by feet or standards, which are screwed firmly down when the ladders are in use, these taking the weight off the springs and giving a rigid base to the whole. The ladders can be extended to a height of eighty to ninety feet in the small period of half a minute. When traveling to the scene of a fire this motor escape can attain a speed of about thirty miles an hour on the level, and it will take gradients heavier than any to be found near London. To insure safe working at night the appliance is fitted with a number of special devices.

Table of Water Equivalents.

The United States Geological Survey prints in many of its Water-Supply Papers a list of convenient equivalents for use in hydraulic computations.

The following is the most useful portion of the list:

1 second-foot equals 40 California miner's inches (law of March 23, 1901).
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one day covers 1 square mile 0.03719 inch deep.
1 second-foot for one day equals 1.983 acre-feet.
1 second-foot for one 28-day month equals 55.54 acre-feet.
1 second-foot for one 29-day month equals 57.52 acre-feet.
1 second-foot for one 30-day month equals 59.50 acre-feet.
1 second-foot for one 31-day month equals 61.49 acre-feet.
100 California miner's inches equals 18.7 United States gallons per second.
100 California miner's inches for one day equals 4.96 acre-feet.
100 Colorado miner's inches equals 2.60 second-feet.
100 Colorado miner's inches equals 19.5 United States gallons per second.
100 Colorado miner's inches for one day equals 5.17 acre-feet.
1,000,000 United States gallons per day equals 1.55 second-feet.
1,000,000 United States gallons equals 3.07 acre-feet.
1,000,000 cubic feet equals 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 cubic foot equals 7.48 gallons.
1 cubic foot of water weighs 62.5 pounds.
1 horsepower equals 1 second-foot falling 8.80 feet.

To calculate water power quickly:

$$\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11} = \text{net horse power on water wheel realizing 80 per cent. of theoretical power.}$$

Personal Notes.

Harry C. Hill has resigned as state engineer of New Hampshire.

W. G. Kirkpatrick has been appointed chief engineer of the city of Birmingham, Ala.

James W. Barrett has been appointed superintendent of water works at Portsmouth, N. H.

Henry Richmond, formerly city engineer of Nashua, N. H., died on February 21 at the age of 88 years.

C. L. James, city engineer of Mattoon, Ill., has been appointed city engineer of Oakland, Ill., by the city council of that place.

R. H. Thomson, for many years city engineer of Seattle, Wash., and for the last few months engineer of the port, has resigned.

George H. Herrold, who has been engaged in private practice in St. Paul, Minn., has been appointed assistant city engineer of that city.

Richard L. Saunders, formerly on the engineering staff of the Board of Water Supply of the City of New York, has become assistant city engineer of Bridgeport, Conn.

Frederick L. Ford, M. Am. Soc. C. E., of the firm of Ford, Buck & Sheldon, of Hartford, Conn., has been appointed city engineer of New Haven, Conn.

W. W. Chaffin has resigned as engineer in charge of track elevation of the Pennsylvania lines at Ft. Wayne, Ind., to become assistant city engineer of Ft. Wayne.

George R. Brown, assistant division engineer with the Massachusets state highway commission at Pittsfield, has resigned to take a position with the California state highway department.

Walter N. Frickstad has been appointed assistant city engineer of Oakland, Cal., succeeding Walter C. Howe, who resigned to become district engineer with the California state highway commission.

H. H. Quimby, M. Am. Soc. C. E., assistant engineer of the bridge division of the Bureau of Surveys of Philadelphia, Pa., has resigned to enter private practice with John G. Brown, Assoc. Am. Soc. C. E., as consulting engineer.

Albert H. Brosius, who has been principal assistant to Sewerage Engineer Hendrick, of Baltimore, Md., since the beginning of the new sewerage system, has accepted a position as chief engineer of sewerage and paving in Havana, Cuba.

Harold C. Stevens has resigned the position of assistant engineer, designer, board of water supply, New York City, and is associated with Johnson & Fuller, consulting engineers and sanitary experts, 150 Nassau street, New York City.

John Wilson has been appointed city engineer of Duluth, Minn. He was connected with the Minnesota state board of health and later was city engineer for Mankato, Minn., for three years, and recently special assistant engineer of Duluth.

MACHINERY AND TRADE

A One-Car Asphalt Plant.

Following is a description of the Merriman one-car asphalt plant, which is manufactured by the East Iron and Machine Co., of Lima, O.

The first essential should be strength to withstand the hard usage to which this class of machinery is subject. The first plant of this type has been in use eight seasons and has laid between 700,000 and 800,000 yds. of finished work—yet it is doing just as good and as large an amount in a season as any new plant.

The asphalt is heated with steam, precluding the possibility of coking or burning the material. There should not be to exceed 360 to 375 degrees of heat used when melting down the material. This degree of heat cannot be controlled by direct heat. With steam heat it can be absolutely controlled. More bad streets have resulted from the use of direct heat in melting down the asphalt than from any other one cause. It is a well known fact that if asphalt is burned or scorched (which can be done very easily with direct heat) it goes into the street apparently all right and it is not known otherwise until such time as the material begins to disintegrate and the contractor wonders why it should do so when he has used the proper amount and mixed it properly.

The steam for melting the asphalt and running the machinery is furnished from a 125-h. p. marine-type return-flue boiler tested at 250 lbs. cold water test, upon which 165 lbs. of steam is carried when necessary. In the first days of portable plants steam heat was employed for melting the asphalt and was not satisfactory. due to the fact that in putting together the pipe coils it was necessary to use connections which would leak inside the tank causing trouble. After the advent of electric welding this method was used in making the pipe coils, making each and every coil continuous from end to end and making it possible to make all connections on the outside of the tank, thus making the coils absolutely proof against leakage. Each tank has four of these coils, containing 1,130 lineal ft. of 1¼-inch double strength pipe so that with steam heat a tank of asphalt can be melted down in four or five hours.

The plant has two tanks, each having a melting capacity of 712 cu. ft., or a combined capacity of 1424 cu. ft.; either tank will hold sufficient A. C. for a day's run. The asphalt pipes for conducting the asphalt to the weigh-box mixer are all steam jacketed, making it possible to run in extremely cold weather without the possibility of the A. C. becoming cold in the supply pipes. One tank can be filled during the day while running from the other, melted down at night and used from the next day, in this way alternating from day to day, making it convenient without any of the annoyance where small kettles are used.

There are four engines on the machine, including the hoisting engine. These are all connected with steel gears and are independent each of the other, making it possible to run any one part independent of the other. The cold sand and stone elevators have clutch pulleys, making it possible to throw them in or out without stopping the machinery.

The condensed steam from A. C. tanks returns to boiler by means of a hot water pump working automatically. The sand drum is 28 ft. long, 5 ft. 6 in. in diameter; this is a return heat drum, the heat passing under and over and returning through same. It is a strong, substantial drum and has a capacity in excess of any possible requirement. It is very economical from a fuel standpoint, owing to its large heating surface.

The hot sand tank, screen, mixer and mixer engine, hoist and elevator engines are all on a sliding carriage on one end of plant which when in use is slid out in position to drive under by means of two large screws. The hot sand bin is raised and lowered by four right and left hand screws, one on each corner, raised when in operation and lowered when ready for the road and saves removing bin from car when being transported. It is a strictly one-car plant, as all parts are carried on the one car. The A. C. tanks are piped for either air or steam agitation. The best of materials of their respective kinds are used throughout and the best of workmen are used in the fabrication; and to quote the words of a practical man on his first examination of one of the plants in operation he said: First, he had never seen as large a piece of machinery so near mechanically perfect; Second, it is built strong

in every part without an apparent pound of surplus material.

It has a capacity of 1800 sq. yds. of 2-inch top or 4000 yds. of 1-inch binder in ten hours. One plant last fall, under ordinary working conditions in 24 working days laid 28,000 yds. of 3-inch finished work. Another plant in 1907 laid 114,000 sq. yds. of finished work; traveled 1185 miles; was set up and taken down 7 times and lost four weeks waiting on materials. Another year 162,000 yds. was laid by one plant, which traveled 1,260 miles. These results were attained, not with any idea of making a record, but simply during the paving season without any effort to make a showing.

The Oshkosh Contractors' Pumps.

The Oshkosh Manufacturing Co., Oshkosh, Wis., have a complete line of contractors' pumps suited to various conditions of work. Among these are both centrifugal and diaphragm pumps.

The portable centrifugal type includes both gasoline engine driven and motor driven pumps. The former range in capacity from 125 to 1,100 gallons per minute, while the latter are made to include sizes from 265 to 1,100 gallons per minute.

The gasoline engine pump is driven by a valveless type engine, direct connected.

The advantage of this type of engine to this outfit is its ability to furnish the power needed at the minimum weight, the portable feature being a great advantage in transporting same to different places. The outfit is complete with batteries, spark plug, switch, etc.

The Oshkosh centrifugal pumping outfits with motors are connected by means of gears, one steel and one cloth gear. This cloth gear will wear and stand the weather and it also eliminates the noise which would come from two steel gears.

The portable diaphragm pump is designed to do away with expensive hand pumping. The pump is of latest design, guaranteed as to its represented capacity and can be furnished with either side or bottom suction. The engine is of the four-cycle type, guaranteed to develop two horsepower, and which at every stroke of the pump lever develops a lift of 1,000 pounds. The power is transmitted from the engine to the pump by means of a gear wheel and crank shaft. The idea of the crank shaft is to do away with all side motion and balance the complete outfit. This outfit may be had in capacities from 3,600 to 7,200 gallons per hour.

The Sieben Machine Cleans Water Mains.

The efficiency of the Sieben sewer cleaning machine on sewer work has been previously noted in these pages, and recent tests have opened a new field of usefulness for a new machine on the same general principles.

The efficiency of the 36-inch flow lines from the Quindaro pumping station to the Kaw river in Kansas City, Mo., had been reduced to about 40 per cent. by reason of the accumulation of foreign material. A contracting firm offered to clear the 18,000 feet of pipe in question for the sum of $7,200. The Sieben System of Sanitation Co., of Kansas City asked to be allowed to demonstrate by test that the pipe cleaning machine before mentioned, could cheaply and efficiently remove the obstructions. Accordingly the experiment was made on January 25th.

The main chosen for the test was a 20-inch pipe which had been in the ground and had not been cleaned for twenty-four years. It was badly crusted with from ¼ to ½-inch of tubercular and rust accumulation before the clearing commenced. The machine operated in a thorough and satisfying manner, leaving the pipe clean and smooth and entirely free from deposit. The pipe-cleaning machine consists of a tube about 22 inches long and 4 inches in diameter with a system of tubes to direct the water over a water turbine perfected and patented by the company for use for sewer cleaning purposes. The improvement for water main cleaning is a system of arms connected to the turbine with a roller cutting wheels attached to the arms that are thrown in and out by centrifugal action.

The turbine and cutters are mounted on runners carrying the machine in the center of the pipe admitting of the same pressure on the interior of the pipe all the way around the inside. This system does not miss a fraction of the pipe in its operation.

The Cobb Face Down Block Machine.

The Cobb adjustable face down concrete block machine is adaptable to making various sizes of concrete blocks of either the hollow or veneer types. It is very simple in construction, being free from springs, levers, etc., and the change in size of the form is made by merely changing the pallets. The cores for the formation of hollow blocks are interchangeable. Blocks on this machine can be made with a rich facing on the front and can also be faced on the back, and the end doors swing back out of the way, so as not to interfere with the block when being carried away.

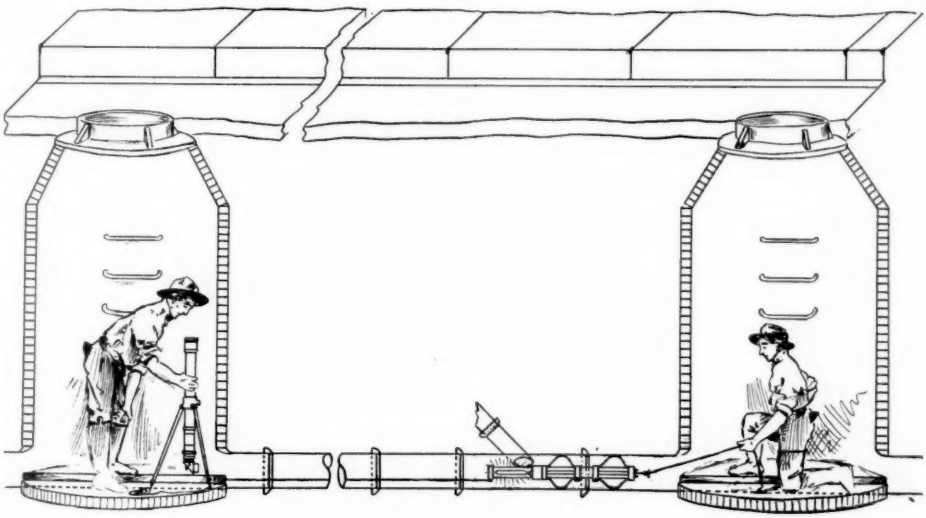
Among the face designs furnished with the Cobb machine are broken ashlar, plain rock divided into two 4-inch blocks, rock divided into one 8-inch and two 4-inch blocks, tool edge, bush hammered, and panel.

The machine is manufactured by the Wm. Cobb Foundry, 209 Clinton street, Jackson, Mich. The company also has a complete line of municipal castings.

A Device for Inspecting Sewers.

Scientific men within the last few years have devoted a great deal of thought to the important question of sanitation. In our boasted supremacy as to education, cities have for years been laying sewers under our streets and the engineer who has designed them has pointed with pride to the details in the placing and construction.

The contract is let, the work completed at great expense and we glorify ourselves in that we have protected ourselves and the future generations from the ravages of disease that would have occurred had we not prepared this our perfect system of sanitation. In a few years we are forced to investigate and we find that our perfect system of sewerage is a myth, and our water supply is charged with disease due to the faulty construction of the sewer. There are numerous instances that can be cited to prove the above statement.



THE G-K SEWER INSPECTION SYSTEM.

Investigation at great expense shows broken pipe, open joints, disintegration of the sewer and many other conditions that bring upon the community sickness due to the pollution of the soil. Custom has proven that a sewer built of small diameter more readily adapts itself to the principles of sanitation from the possibility of the flow flushing it and keeping it in proper condition. But in building these small sewers what guarantee has the engineer or the city that is paying for same that this sewer is well constructed?

Inspection after the sewer line is laid shows a line of 6-inch, 8-inch, 10-inch and 12-inch pipe, which, if examined before back-fill has commenced, seems to be laid in perfect alignment and perfectly jointed. A further inspection by use of light at one manhole and mirror at next manhole shows merely a hole through the ground. Sewers laid and inspected as above have been tested by interior water pressure by plugging sewer pipe at the lower end of a grade and with fire hose filling line from upper end with the result in many cases of inability to fill the line, showing a leak at some point between.

The necessity of locating the weak points in sewers caused W. W. Dixon to have made a telescope mounted on a tripod, the telescope having an object glass and a right-angle prism. An electric torch of 8 candle power is suspended in the center of the sewer pipe by a series of springs adjustable to various sizes of pipe. A string is passed through the pipe line by either float or sewer rods and the torch attached and drawn through the sewer. At the end of the torch towards the operator with the telescope, is attached a graduated tag line. As the torch is drawn through the sewer the light illuminates the entire interior of the sewer for a distance of about 18 to 24 linear inches. The operator with the telescope then focuses on this illuminated point and is enabled to locate cracks, breaks, house branches and leaky joints; and by the use of the tape locates to a very close degree the distance of these defects from the manhole.

The accompanying sketch shows the manner of use. This instrument is patented and is known as the G-K Sewer Inspection Device, owned by the Union Clay Products Co., 40 Church St., New York.

The Sycamore Maul.

"A maul that is a maul" is the descriptive phrase with which the Sycamore Maul Co., of Syracuse, Ill., describe their product. So small a detail of the contractor's equipment

as a maul often is allowed to shift for itself, and it is customary to send a workman to the nearest source of supply with an order to "get a maul" when, as frequently happens, the one in use goes to pieces. With attention given to the workmen's slightest movement, so as to secure efficiency and avoid waste, with all available material carefully saved, the contractor uses simply any maul.

For certain classes of work, such as trench sheeting, etc., a wooden maul is desirable and the Sycamore maul possesses particular merit. The head is made of the best seasoned hard wood, selected and carefully prepared. The handle is of straight grained hickory and is carefully fitted and keyed into the head. Iron bands are placed around both faces of the head, and these are held firmly in place by a stay rod, which is fitted in a groove along the side of the maul head and bent over both of the bands while hot. This latter feature makes it impossible for the bands to become loosened and come off. It may be obtained from the Sycamore Maul Co., Sycamore, Ill.

Steel Playground Apparatus.

Park boards, playground officials and school authorities cannot but be impressed at this season with the weather's destructive effect upon most of their playground apparatus. The winter's rain, snow, sleet and wind has played havoc with the swings and teeters which were purchased perhaps no longer ago than last spring. The stout ropes are now shreds of hemp, the teeters are warped and cracked, and all of the apparatus which has been in occasional use during the few bright days of winter has been rendered unfit by the action of the elements.

The Medart Steel Playground Apparatus, made by the Fred Medart Manufacturing Co., Dekalb and President streets, St. Louis, Mo., is made to withstand these destructive agencies. The Medart apparatus is built entirely of steel and then galvanized, and will positively resist the elements of the weather under constant exposure and it is practically indestructible even under the severe use and abuse it is subjected to in the average public playground. It is free of any attempt at elaborateness.

A very complete catalog by this company illustrates a wide variety of swings, horizontal bars, flying and traveling rings, slides, etc., all constructed of steel. Four gymnastic outfits are illustrated in this catalog to permit of a selection for the average purpose, or these standard outfits can be modified to suit peculiar requirements. If necessary the company will draw plans for special outfits of this character, although standard outfits can be sold at comparatively lower prices. A complete playground equipment ordinarily consists of a gymnastic outfit, swing outfit, seesaws, circle swing and slide. In more complete equipments baby swings, revolving parallels, horses, bucks, etc., are also included.

The pipe for the swing frames, etc., can often be bought in local markets at a saving to the purchaser. The Medart Co. quotes the pipe independent of the apparatus and special fittings, so that a comparison of prices can be made with the prices of local supply houses. They invariably recommend the use or specitl fittings for putting the frames together, as they very greatly facilitate erection. These special fittings are not threaded and their use makes possible the erection of the frame with ordinary workmen. Complete instructions for each detail of the work are furnished and no item from digging the holes to attaching the apparatus is left unmentioned.

The fact that constant exposure and use under the most severe conditions necessarily make durability the essential consideration was recognized almost from the very beginning and careful observation of the apparatus in use resulted in continual improvement, but as playground work became more effective, the use of the apparatus became more excessive, and nearly fifteen years' time was consumed in perfecting the present construction. The principle of this construction is the elimination of practically all wooden parts and this idea was originated by Mr. Fred Medart.

"Pozite" Joint Cement.

F. H. Hough, 17 Battery Place, New York, N. Y., has invented and is manufacturing a pipe joint cement which he particularly recommends for pipe which is laid in wet trenches. The material which is sold under the trade name of "Pozite" is a fine powder, containing an intimate mixture of sulphur and specially prepared and combined in such proportion as to melt readily at about 240 degrees Fahrenheit, a little over the temperature of boiling water. The process of using the material is briefly as follows.

The joints should first be thoroughly caulked with jute packing well rammed down. Any form of joint runner is then fastened around the pipe closing the mouth of the bell, and the annular space between the bell and spigot is filled with molten "Pozite," which is poured in the same way that lead is poured in laying cast iron water pipe. The joint runner should be damp to prevent adhesion of cement, and a little moist clay should be used to prevent overflow at the top of joint. In practice, with small pipes up to 10 or 12 inches, it is found most convenient to join two or three lengths of pipe on a cradle on the surface of the ground, so that but one joint out of every three or four need to be made in the trench. The joined sections can be freely handled and lowered into the trench within a few minutes after pouring. When there is water in the trench, it must be kept down, of course, while the joint is being made, but only for the few minutes required to pour, and the water can be allowed to rise immediately afterward.

In laying pipes in wet trenches, the ditch

should be excavated about six inches below the bottom of the pipe, which should be blocked up to grade. The water is thus more readily kept away from the bells. After the water has been reduced the bell must be wiped dry and care must be taken to see that no water enters the bell before the joint is poured. It is well to provide a wooden plug to close the free end of the pipe. In the case of large pipes, 15 or 24 inches in diameter, a proper bed should be made, of course, to support the pipe.

The table below gives the approximate quantity required per joint:

Pipe.	Lbs. Per Joint.
24 inch	10.0
22 inch	9.0
20 inch	8.0
18 inch	7.0
15 inch	5.0
12 inch	4.2
10 inch	3.3
8 inch	2.5

The Water Works System of Centralia, Mo.

The Des Moines Bridge and Iron Co., Des Moines, Iowa, have recently completed the construction of a complete water works system for Centralia, Mo., which is very complete and a most efficient small town plant.

WATER WORKS PLANT AT CENTRALIA, MO.

Centralia has a population of 2,500. A. Bishop Chance is mayor and J. C. Stewart is clerk.

The water supply for the system is secured from a 10-inch drilled well 700 feet deep tapping a quantity of water of an excellent quality. It is pumped from the well into a clear water reservoir shown in the foreground of the accompanying photograph. This reservoir is of concrete 45 feet in diameter and 6 feet deep. From here it is pumped into the hemispherical bottomed steel tank of 70,000 gallons capacity supported on a tower so that the top of the tank is at a height of 125 feet above the ground.

The power machinery is contained in a 48x59 foot brick pump house, with a brick chimney. The boiler equipment includes two 60-inch by 16-foot boilers, and the power machinery consists of one 125 h. p. engine, two 75 k. w. generators and one 500 gallon per minute duplex pump and one 300 gallon per minute triplex motor driven pump.

The distribution system serves 57 fire hydrants through 35,000 feet of cast iron mains. The total cost of the plant including power equipment and distribution system was $55,000. Burns and McDonnell, Kansas City, Mo., were engineers.

The Des Moines Bridge and Iron Co. construct a great many complete water works systems. Among those which they have recently completed are water works plants for the cities of Winterset, Iowa; Adair, Iowa; Farmington, Minn.; Onida, S. Dak.; Chappel, Neb.; and Highmore, S. Dak., and they have under construction water works plants for Prescott, Wis.; Shelbina, Mo., and Waterville, Kan., also Rushville, Ill. These plants range from $15,000 to $65,000 each.

The Two-Car Asphalt Paving Plant.

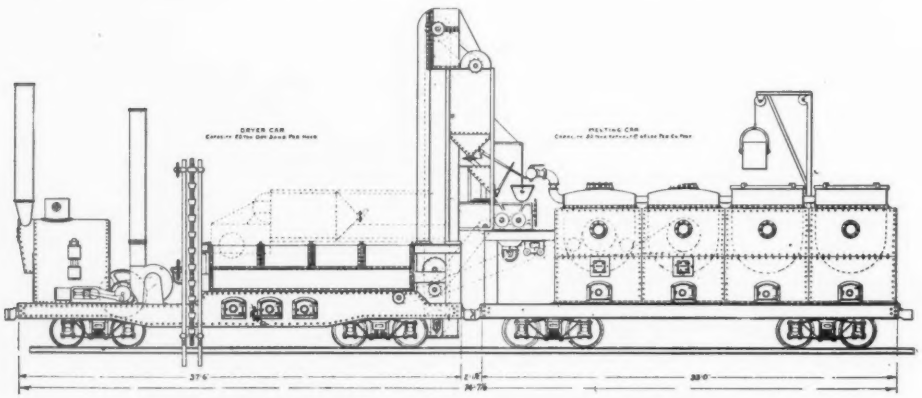
The first railway asphalt paving plant consisted of two cars, one being known as the dryer car and the other as the melting car. For nine years or more this was the only type of railway plant known; its invention originated with Hetherington & Berner, Indianapolis, Ind., as was decided by the United States Patent Office in a case in which the validity of the Hetherington patent was contested by the greatest company in the asphalt paving business at that time. The great success of the Hetherington two-car railway plant is now a part of the history of the asphalt paving business in this country and marks the beginning of that period of vast expansion in the use of asphalt as a paving material which has seen it come into general use in even the smaller towns, a thing not thought possible before the advent of the railway plant.

Improvements in the design, construction and capacity of the first plant took place very rapidly, until the Hetherington two-car railway plant achieved the capacity for turning out material for 2,000 square yards of finished 2-inch topping per day.

Then came a demand for a plant of less capacity. One of the leading paving contractors, who had been operating very successfully with the two-car plants, came to the conclusion that it would be a better business proposition to own two plants of about 1,000 square yards capacity rather than one plant of 2,000 yards capacity; this for the reason that after several years experience he had found that paving jobs of from 10,000 yards to 30,000 were plentiful,

and that for jobs of such size a smaller plant would be more economical, while jobs of such size as to demand the capacity of the two-car plant were not so frequent and when he secured one of the larger ones he could operate both of the one-car plants upon it, with but one superintendent and one foreman. When not operating conjointly on a large contract then the smaller plants could work separately; thus enabling him to keep several jobs going at the same time. It was because of this sound reasoning that Hetherington & Berner brought out their celebrated one-car railway plant. But there were yet other paving contractors who still desired a plant of large capacity.

The principal features requiring consideration and investigation in the solution of this question were, first, the traveling weight of the outfit itself, taken in connection with the length of car which would be required and the distribution of that weight upon a



THE HETHERINGTON & BERNER TWO-CAR ASPHALT PLANT.

car of that length; second, the relation of such an abnormally long and heavy car to the curves over which it might have to pass during its travels; third, the relation of such a car to the various tunnels that might be met with on the road, and, fourth, the distribution and arrangement of the machinery of the plant itself in order that each part or mechanism might be in such position that it could be readily gotten at for the purposes of operation and making repairs.

It is to meet the requirements set forth in the foregoing that Hetherington & Berner advocate the use of the two-car railway asphalt paving plant where capacities greater than 1,000 square yards per day are required, rather than a one-car plant.

The two-car railway asphalt paving plant which is illustrated herewith represents a plant that is even more mobile than the one-car plant, while at the same time it can be furnished of any capacity up to and even more than 2,000 square yards of 2-inch thick asphalt topping per day. In the design of this new plant have been incorporated most of the features of the old Hetherington two-car plant, and added to these features are those of particular excellence which have hitherto pertained only to the Hetherington one-car plant, the principal ones being the fold-down hot sand bin, the fold-down hot sand elevator and the helicoid conveyor mixer delivery apparatus which, while discharging the contents of the mixer to the waiting wagon, gives a secondary or double mix to the material, so that not the slightest quantity of unmixed sand can be found in it.

From an examination of the illustration it will be seen that neither one of the two cars which combine to make the plant complete is of extraordinary length; in fact both of them are somewhat under the length of the ordinary gondola or flat car of common use. Separately or coupled together these cars are able to negotiate any railway curve, any tunnel, any bridge and can be weighed upon any ordinary railway scales, and the combined length of the two cars is but little greater, if any, than that of certain one-car plants that have been offered to the trade. It will also be noted from the illustration that there is no part of the machinery of this plant that projects below the body of the car and hangs in dangerous proximity to the tracks.

The new style two-car Hetherington railway asphalt paving plant may be had in two sizes, one having capacity for 1,500 square yards per day and the other for 2,000 square yards per day.

In the design of this plant have been embodied the features of mechanical agitation and melting by direct heat, two features of absolute importance to a first-class asphalt paving plant, whether railway or stationary. It is altogether probable that the time is not far distant when the use of mechanical agitation will be made mandatory by all cities issuing specifications for that kind of pave-

ments; the reasons for this, and also the reasons for the use of direct heat for melting, instead of steam heat, are fully set forth in a pamphlet entitled "Pointers for Plant Purchasers," which may be had of Hetherington & Berner.

A New Reversible Spreading Dump Car.

The Port Huron Engine & Thresher Company, Port Huron, Mich., have just placed on the market something entirely new in the way of a spreading dump car. It differs from all others in having a hand steering device at each end, and is designed especially for use on narrow or crooked roads.

Each end is provided with a bumper or tongue, which can be made rigid by inserting a lock pin, or may be made flexible by its removal. It can be pushed or pulled to any desired location. Like their regular spreading car it is made of all steel and iron and is exceptionally staunch and durable.

The advantages of this car will appeal to road builders who have had experience on narrow roads where there was insufficient room to get alongside with engine or roller.

With a train of these cars, when spreading stone on a narrow road, to avoid running up onto stone already spread, they can be pulled to one side of the road and dropped about 15 feet apart. This will allow sufficient room for the engine to get back alongside and by use of the steering device cars can be pulled from almost any angle and dropped just where wanted. When so placed they can be coupled together, the engine hitched onto the last car and stone spread while leaving for the next road. With the steering device where roads are crooked or narrow, cars can be handled one at a time much quicker than could the whole train.

THE PORT HURON REVERSIBLE DUMP CAR.

The Staley Power Tamping Machine is Successful.

Recent tests conducted by a number of cities and private corporations have demonstrated the value of the Staley Power Tamping Machine, manufactured by R. H. Staley, Box 229, Springfield, Ill. The necessity of proper tamping of back filling is becoming more recognized and both municipalities and private contracting firms are finding it to their advantage to properly refill trenches.

Alexander J. Taylor, chief engineer of the city of Wilmington, Del., commends the machine and states: "We have had it for about six months now, during which time it has run smoothly and there has been no trouble with the mechanism. We have not, at hand, any data as to the cost of the work but it seems to effectively do the ramming for about six shovelers. We are well pleased with the machine and have not had any settlements in the ditches rammed by it. In some cases where the pipe installed was not over 10 inches in diameter all the earth excavated from the ditch has been replaced and none hauled away."

F. C. Shepard, superintendent of the Minneapolis Gas Co., Minneapolis, Minn., states that the company has used the machine extensively and says regarding it:

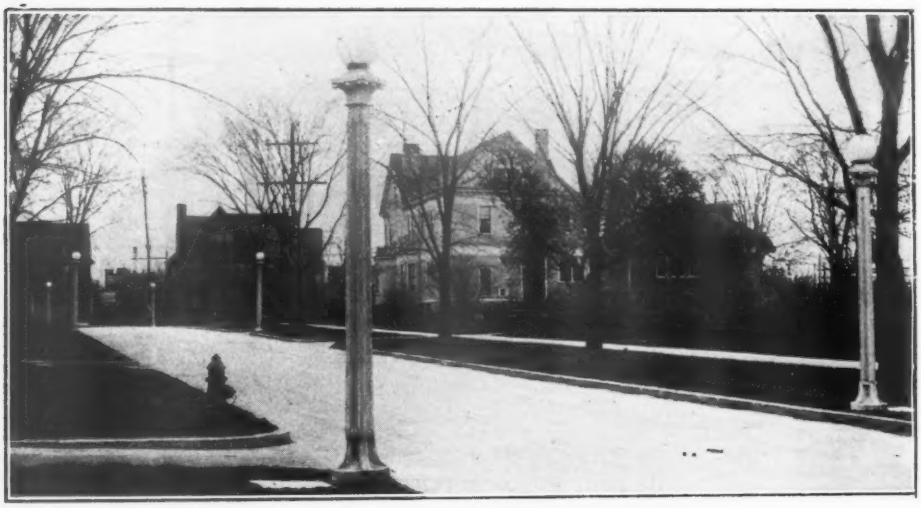
"It worked very successfully last summer and was able to do the work of ten men with two; in other words, it replaced eight men in tamping on all our pavement and railroad yard work, and we feel that it was a very good investment for the company. The cost of operation is very slight, both as regards maintenance and gasoline."

The machine, a gasoline engine driven tamper mounted upon wheels so as to be easily pushed along over the trench, has been fully described in these pages.

A New Concrete Lighting Standard.

The use of concrete as a material for the making of ornamental lighting standards is by no means new, as it has found favor in this field for a number of years. It has been proven to be a medium which allows the display of a wide variety of taste in design and execution, and is, of course, durable and economical. These latter facts have been shown to be true by the installation of concrete ornamental posts in a number of the large parks and boulevards throughout the country, notably in Lincoln park and drives, in Chicago.

The National Mixer Co., Mercantile Building, Rochester, N. Y., have perfected a form for the manufacture of a very attractive single light standard known as the Zem-Art standard which possesses the merits of being light and strong in construction and so fitted and finished as to assure of a smooth and well-formed product. The National Mixer Co. furnish the mold and an extra pallet complete and promise an output of one standard a day for each form.



ZEM-ART CONCRETE LIGHT STANDARDS IN ROCHESTER, N. Y.

The lighting company of Rochester installed about 200 of the standards during 1911 and it is stated will double this amount during 1912. The company has expressed its entire satisfaction with the standard both as regards its artistic design and by reason of the fact that it requires no painting nor repairs, can be easily cleaned and washed, and that it improves rather than deteriorates with age.

The Blome Concrete Pavements.

The Blome granitoid and granocrete pavements are not a creation, but are a development of types of a concrete pavement arising from experiments extending over a number of years. That the granitoid pavement, the first of the above mentioned types, has been successful is testified by the fact that they have been constructed under practically every condition of climate, upon grades and over a wide variety of foundations and many of the cities which first tried it have adopted it repeatedly in after years. The methods of constructing both the granitoid and granocrete pavements are patented by Rudolph S. Blome Co., City Hall Square Building, Chicago, Ill.

In the granitoid pavement a 5 or 6-inch concrete base is prepared as in the case of a brick pavement. Upon this is deposited a granitoid blocking 1¾ inches thick and containing one part of Portland cement to one and one-half parts of crushed granite or trap rock of the following composition: 50 per cent. of the granite of ¼-inch size, 30 per cent. of the ⅛-inch size and 20 per cent. of the 1-16-inch size. This material is thoroughly mixed and deposited on the concrete base after wetting. It is then worked into brick shapes of approximately 4½x9 inches, by means of special grooving apparatus. Expansion joints are provided for as needed.

The granitoid pavement has proven sanitary in that it is easily kept clean, it is not slippery and has stood up exceptionally well under traffic.

Granocrete pavement is a further development evolved through experiments tending to develop a less expensive concrete wearing surface. Granocrete provides a pavement which is especially adaptable for streets and boulevards of lighter traffic and for highways, a pavement which does not become slippery or dusty, and furthermore one that can be constructed at a low cost and minimum outlay for maintenance.

The surfacing of granocrete pavement is prepared with accuracy as to formula of composition and is based upon completely filling the spaces between the particles of crushed stone with a mixture of sand and cement in such a manner to reduce the voids to a minimum. The mixture of this surfacing is such that all portions of the stone are completely encased, the particles of stone are so placed in the wearing surface that all the wear comes directly on thel and the sand and cement merely act as a binder of the surfacing material.

More detailed information regarding these two types of pavement may be obtained from Rudolph S. Blome, City Hall Square, Chicago, Illinois.

Creosoted Yellow Pine for Pavements.

J. C. Dionne, editor of *Southwest* at Houston, Tex., makes a few telling statements at the close of an article on wooden blocks for paving Houston streets which are worth repeating. They are as follows:

The lumber men are going to prove to the citizens of Houston—not that the yellow pine block pavement is the best paving to be had—but that it is the only thoroughly successful and satisfactory pavement of modern times. The experiences of the many cities of the United States, Canada and Europe that have tried this pavement all demonstrate the truth of this saying. There is not a dissenting vote where the block pavement has been used; that is, the yellow pine block pavement.

The writer has recited previously the experience of Philadelphia, which sent a deputation of citizens accompanied by an engineer all over the world to decide what is the best modern pavement, and the commission voted unanimously for creosoted yellow pine blocks.

The United States government is conducting a wood block pavement experiment in Minneapolis, as recently noted in *The Chronicle*, and their recent report on the yellow pine blocks broke the world's paving records. The report shows that the wear was entirely smooth and uniform, that it amounted to one-sixteenth of an inch after six years' use under heavy traffic, which means that it would take ninety-six years to wear off an inch of this pavement, and that it would wear smoothly, at that.

The best paved streets in America and Europe are creosoted block pavements. Houston is full of citizens who have ridden on Michigan avenue in Chicago and commented on that magnificently paved boulevard, and the chances are a hundred to one they never dreamed they were riding over a common Texas wood paving block. Others who have enjoyed a spin on Fifth avenue, New York, would probably be surprised to know that it is paved with yellow pine.

And so on with a score of our large cities. Their first-class pavements are yellow pine blocks.

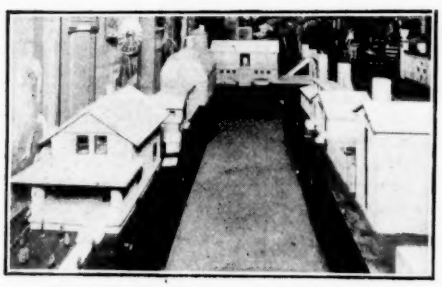
They are sending from the North for millions upon millions of feet of yellow pine for their main streets, and are praising these pavements to the skies; yet Houston, the leading yellow pine block selling city of the world, has never laid a foot of block pavements, except the old round block pavements without foundation, that were on eyesore for years.

The lumbermen are going to urge their fellow-citizens to pave Houston with "the perfect pavement," and have streets to be proud of. They are going to detail the value of creosoted blocks set on a concrete foundation and laid almost exactly like a brick pavement. They are going to indorse and guarantee it, and when they have finished their campaign the Houston people will have had full opportunity to know the full value of the yellow pine block.

Concrete Models of Farm Buildings.

At the recent Chicago Cement Show the Chicago Portland Cement Company appropriately installed an exhibit consisting of no less than thirty all-concrete models of farm buildings and miscellaneous structures on the farm, photograph of which is here reproduced. The visitor who inspected this exhibit was quick to grasp the wonderful utility of cement on the farm. It was an original, convincing display.

Located on the main aisle of the Coliseum Building, this exhibit occupied approximately 400 square feet. The idea was to exhibit only such concrete work as could be successfully accomplished on the farm, and to demonstrate it in the simplest manner possible. Wall construction was shown by a reinforced concrete wall of plain design, four feet high, which enclosed part of the exhibit, a space



CONCRETE MODEL FARM BUILDINGS.

10x12 feet. Concrete urns cast from an ordinary metal wash basin, such as is found in every farm home, were placed at intervals along the top of the wall, while a metal cuspidor served as the mold for the base of these urns. The use of concrete blocks was shown in a wall 3½ feet high which intersected the exhibit, while the widely discussed concrete furniture, comprising two tables, four chairs, one bench and two small milking stools, was also exhibited at this booth.

All of the models were built to the scale of one inch to the foot, the residence as shown in the picture being 22 inches wide, 36 inches deep and 28 inches high. It is a two-story, seven-room structure; was decorated interiorly, completely furnished, telephone equipment and other modern farm conveniences, and electrically illuminated throughout. Fronting the house was a long stretch of concrete roadway, concrete curb, sidewalk, stepping block, hitching post, and

on the lawn was a concrete roller. To the rear of the residence were located the following models, all in concrete, in the order named: Cistern, well house and windmill, dog house, smoke house, ice house, garage, carriage and wagon shed, horse and hay barn with watering trough adjoining, dairy, cow barn with silo and elevated water tank, circular watering trough and machinery base adjoining, the concrete approach to the second story of the barn being utilized as a root cellar, a concrete feeding floor with manure pit extending between the cow barn and the hog house, corn crib and granary; and lastly, a chicken house. The miscellaneous models include concrete steps, drain tile and culvert.

Frank A. Caldwell, concrete contractor, 4723 Halsted street, Chicago, built the entire exhibit.

The Motor Fire Engine of Navesink, N. J.

The accompanying photograph shows a very interesting piece of motor fire apparatus manufactured especially for the village of Navesink, N. J. It is a special adaptation of a heavy touring car chassis to fire service and the combination was made at a very reasonable expense to the village.

The car is a fifty to sixty horsepower Thomas car with an overall length of seventeen feet with a Goulds bronze fitted rotary pump, manufactured by the Goulds Manufacturing Co., 131 West Falls street, Seneca Falls, N. Y. The weight of the apparatus complete is 4,000 pounds. The cost complete was only $2,800.

The pump runs at a speed of 350 revolutions, supplying 350 to 400 gallons per minute. It has 5-inch suction and 2½-inch discharge.

MOTOR FIRE ENGINE, NAVESINK. N. J.

The Kalamazoo Trench Braces.

The Kalamazoo Foundry & Machine Co., 576 East Main street, Kalamazoo, Mich, make a special line of trenching braces which embody features of construction of particular merit. Among the types shown in their descriptive leaflet are the regular forms of trench braces, ranging in length when extended from one foot to four feet ten inches, heavy braces from three feet to six feet six inches, and ball and socket braces from one foot to six feet eight inches.

The Kalamazoo timber brace fittings are suitable for use in any width trench except the narrowest. They are especially useful in wide excavations. The screws are of stiff steel, and the bracing of the caps in the larger sizes make these braces most desirable for heavy and severe service. Cutting thread in cap makes these so that they may be safely extended within two inches of length of thread on screw.

With a pressure of 140 pounds at the hydrant the pump will throw a stream 100 feet and will throw a solid stream eighty-five feet straight up through 750 feet of discharge hose.

The "Perfect" Curb Box.

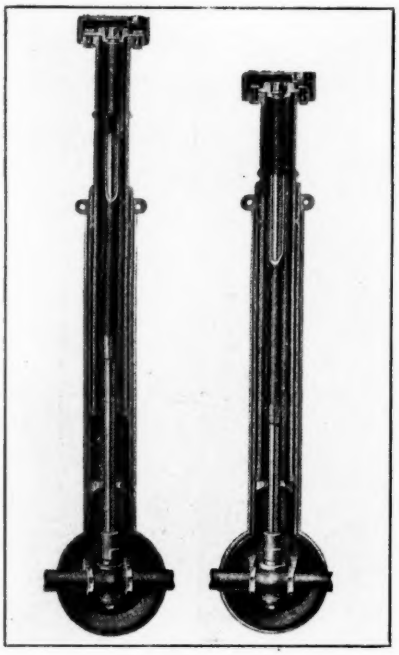
With the ordinary curb box, which has remained standard through the developing and perfecting of other water works equipment, trouble is often experienced, due to "freeze-ups" and the accumulation of dirt about the service cock. The E. T. Valve and Hydrant Company, 50 Church street, New York City, has given its attention to the bettering of the old standard, and the "Perfect" curb box is the result.

As will be noted from an examination of the accompanying photograph, the bottom of the box is completely enclosed, so that it is impossible for dirt or gravel to force up

from beneath and obstruct the service cock. A support is provided upon which the valve rests in such a manner that it is maintained in its position.

The extension type shaft provides for the adjustment to different depths as needed, and as all frost upheaval tends to raise the lateral or bottom of the ordinary curb box, the extension provision will allow for this action and leave the service line undisturbed.

Style 1 is provided with a telescoping valve rod which adjusts itself to correspond to the adjusted length of the box. It fits any style valve. This valve rod eliminates



STYLE I, "PERFECT" CURB BOX.
Showing adjustment allowed in length.

the long, solid wrench and renders removal of the outside cover unnecessary. Style 2 is exactly the same as style 1, except for the valve rod. A special inside cover is furnished for style 2 that is locked in position or removed by a quarter turn of the key, the same key being used for both covers. When the inside cover is removed the wrench may be lowered to the valve. A division plate is placed immediately above the valve, so that if the wrench should drop it will not strike the valve. The plate is provided with an opening corresponding to the opening of the inside cover and to the shape of the head of the wrench. Style 2 curb box can be changed to style 1 by inserting the telescoping rod. The double top is of advantage in case the upper cover becomes broken, as it frequently does; as in that event the lower cover still remains to protect the box and exclude all dirt and debris. This double cap, the practically double-side casings and the enclosed bottom make the box a good protection against freezing.

The prices of the "Perfect" curb box are somewhat higher than the ordinary box, but the difference is not sufficiently great to cut any figure as against added convenience and elimination of possible consequental damage.

Road Exhibit at the Chicago Cement Show.

The Universal Portland Cement Company, of Chicago and Pittsburgh, devoted the larger part of its exhibition space at the Fifth Annual Chicago Cement Show to a display demonstrating the use of concrete as a paving material.

The engineer found the exhibit both educational and interesting. The types of pavement that were shown brought out the idea that permanency in pavement is essential to satisfactory country road construction, just as it is to city street building. In the first of the five booths a two-coat concrete pavement was shown. This was composed of a wearing surface of 1 part cement, 1½ parts of a mixture of 3 parts ¼-in. to ½-in. granito and 2 parts granite screenings. The base consisted of 1 part cement, 3 parts torpedo sand and 5 parts limestone. The expansion joints were protected by Baker steel plates.

In the second booth a brick wearing surface was laid after the recommendation of the National Paving Brick Manufacturers Association upon a standard concrete base, such as should be used under all permananet pavements. The base was composed of 1 part cement, 3 parts torpedo sand and 6 parts limestone.

In the third booth a concrete pavement with a wearing surface of bitumen and sand, such as is used at Ann Arbor, Mich., was laid upon a base composed of 1 part cement, 2 parts torpedo sand and 4 parts screened gravel.

The fourth booth was a representation of a type of pavement that covers thirty-three miles of road in Wayne county (Detroit), Michigan. This single-coat concrete pavement is composed of 1 part cement, 1½ parts torpedo sand and 3 parts screened gravel. The expansion joints were placed twenty-five feet apart and protected by Baker steel plates. This exhibit proved especially attractive to engineers and highway commissioners generally. The Wayne county pavements have excited country-wide interest among good roads men.

The fifth booth showed a pavement with a wearing surface of 1 part cement, 1½ parts of a mixture of 3 parts ¼-in. to ½-in. gravel and 2 parts torpedo sand. The base consisted of 1 part cement, 3 parts torpedo sand and 5 parts gravel. The expansion

joints in this case were protected by 2x2½x3-16-in. angle iron. The reinforcing material used was No. 7 triangle mesh.

Concrete pavements with concrete wearing surfaces may be laid at a cost of from $1.00 to $1.50 per yard varying with local conditions, and upon the concrete base shown various wearing surfaces may be laid which will make the road structure permanent, but which will increase the cost of construction.

Steel Dump Cars in Street Excavation Work.

An example is shown in the accompanying illustration of the efficiency of steel dump cars for the economical handling of earth and material for filling. The photograph was taken in New Castle, a town in Western Pennsylvania, where a number of steep hills provide difficulties in street construction.

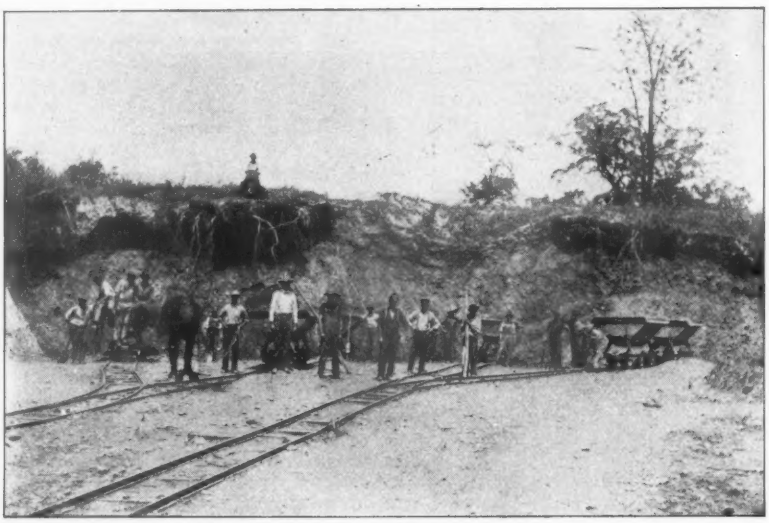
In making a street extension in New Castle, recently, 35,000 yards of earth had to be hauled a distance of 3500 feet to make a fill 40 ft. in depth, 50 feet wide at the top, and 150 feet at the bottom. Running across the bottom of the fill was a five foot concrete sewer 150 feet in length.

The big problem was the transportation of the material to make the fill, but the contractors, Wards and Golden Construction company of New Castle, solved it quickly, efficiently and economically, using a complete portable railway, consisting of 3500 ft. of 24 gauge portable track with switches, and 15 Koppel "V" shaped steel dump cars, each of 36 cu. ft. capacity. These were hauled by horses.

And the haul of the loaded cars was practically all down hill, the greater part of a 3 per cent. grade, but for a short distance a 10 per cent. grade was encountered. Down the 3 per cent. grade the cars were held in check with a pole used as a brake, with a heavyweight block on the end, and on the 10 per cent. grade, a hoist was used to raise and lower the cars.

The portable railway and cars were built by the Oronstein-Arthur Koppel company in their works at Koppel, Pa.

All material was hauled by these Koppel cars, and the work done at a cost of from 24 to 30 cents per cubic yard. This included every item of expense. This is remarkably low, and especially so when the distance of the haul is considered and the difficult grades encountered.



STREET EXCAVATION IN NEWCASTLE, PA.

Some Novel Features in Fireproof Construction.

BY W. H. RADCLIFFE.

The Vanderbilt Hotel, at Park avenue, Thirty-third and Thirty-fourth streets, New York City, shown in the accompanying photograph, is the last word in fireproof hotel construction.

If a fire should start in any part of this building it would simply consume the inflammable contents confined at the point of the fire's origin. Owing to the fireproof, hollow-drawn-steel and asbestos-filled construction of the doors and all interior trimming, coupled with the stone and metal construction of the elevator shafts, doors and stairways, a fire could not spread, because it could not eat its way from room to room, or from floor to floor. That this is an actual fact and not a theory was demonstrated by a fire that started in the corridor on the third floor

three days after the official opening, and which was controlled with ease.

Each guest chamber, or suite, is virtually a building in itself, and although a fire may start in a dozen of them at the same time and on various floors, the safety of the hotel is not affected.

The insulation of the garbage room and of the servants' dining room presented an unusually difficult problem. It had to be of the highest efficiency, not so much on account of preventing fire, as to prevent the heat from the boilers spreading and raising the temperature in the room above.

Unlike most hotels, the servants' quarters, instead of being on the top floor, are on the third floor. This innovation was partly due to the top floor being considered the most desirable in the building on account of the extensive view afforded to the north, south and east. The Vanderbilt apartments, comprising nine rooms, are located on the top floor. The servants' quarters being on the third floor allow this floor to be used as a distribution center for the electric cables running up through the building and all piping of mechanical equipment. Thorough fireproof and soundproof insulation in the form of J-M asbestos plaster is used in the walls of the servants' rooms.

Guided by the report of the United States Geological Survey that 60 per cent. of the fire danger to buildings comes from exterior fires, unusual care was taken by the architects to insure an absolutely fireproof roofing for the hotel. The entire top of the building was therefore covered with J-M asbestos roofing. Over this a layer of vitrified tile was laid. A pent house on the roof is also covered with the same roofing.

Fireproof construction has been carefully followed in the foyer and halls, which are built largely of marble and Caen stone. The lighting has been especially well handled in the foyer, where J-M linolite electric lamps, screened with attractive reflectors, give a soft, pleasing effect, and amber frosted lamp bulbs in brackets and cut-glass chandeliers add to the attractiveness.

THE NEW FIRE-PROOF VANDERBILT HOTEL, NEW YORK CITY.

With the exception of the pictures, the marble and some of the bronzes, which were imported, the Vanderbilt Hotel represents throughout the work of local manufacturers, architects and builders. So far as the J-M fireproof materials described in this article are concerned, the H. W. Johns-Manville Company, New York, was the manufacturer. The Ajev Company was the general contractor, and Warren & Wetmore were the architects.

The Casey-Hedges Ornamental Standards for Street Lighting.

Ornamental lighting, by reason of the many different street plans, the variations in height and kind of buildings, the width of roadway and its relation to sidewalk and parking area, lends itself to a display of taste and originality in the choice of lighting standards. With a view to supplying designs to suit the different conditions, the Casey-Hedges .Co., Chattanooga, Tenn., have a great number of patterns, some of which are particularly deserving of mention.

The "Colonial" standard is characterized by its broad, generous lines, extreme simplicity and dignity. It consists of a square base and column but slightly more ornate ports on its capital another short column section which supports the center globe erect and four pendant globes upon cross-arms of consistently plain design.

The "Doric" standard, is similar as to base and column but slightly more ornate as regards the cross-arms, the four erect side globes and the urn which supports the center globe at a well proportioned distance above the others. The length of the cross-arms gives a distance between the side lamps which is six inches greater than in the ordinary type of standard. Its weight is approximately 1300 pounds.

There are eight designs shown in the circulars issued by the company, and they are of such character as to allow of a wide range of choice in selection.

A Mineral Waterproofing.

Ironite, a product manufactured by the Ironite company, 716 Oxford Bld'g., Chicago, Ill., is a metallic waterproofing for all sorts of cement products, brick, stone and other porous substances. The material is in the form of an exceedingly fine metallic powder being strictly a mineral substance and having no oil, paraffine, asphalt or other similar substances in it.

In applying it, Ironite may be mixed with water to about the consistency of ordinary whitewash, and spread upon the desired surface with a brush, or similiar method. The water will carry the particles into any cavity that moisture will penetrate. Its value as a water-proofing is due to the fact that when thus introduced into the voids of concrete, brick work, etc., the particles oxidize, expand and form both a mechanical and a chemical union with the concrete, and become an inseparable part and parcel of same. It cannot be removed except with strong mechanical force, as "hammer and chisel;" and then only by taking a part of the concrete with it. Ironite can be applied either to a wet or a dry surface, and to a structure in course of erection, or to one many years old. It may be applied either to the inside or the outside of a structure, and against waterpressure.

Ironite is shipped in metal cans containing 8, 25, 50 and 100 pounds, respectively. It may be purchased by the consumer, and used according to the instructions, or if preferred, the work may be done by one of the contracting companies. In the latter case, if desired, the work will be guaranteed.

Recent Tests of Jointite.

Thomas B. Stillman, chemical engineer, connected with the Stevens Institute of Technology, Hoboken, N. J., and Edwin J. Fort have recently completed tests of the properties of "Jointite," a pipe jointing compound manufactured by the Marbleloid Co., 1328 Broadway, New York, N. Y. Mr. Stillman's report was, briefly, as follows:

This compound has great adhesiveness and pliability at normal temperatures and does not lose these properties after being frozen (10 degrees F.), and then thawed thirty times. It is somewhat brittle at 20 degrees F., but this is not a temperature existing in your working conditions. It is water-proof and it retains its elasticity underground.

It is a non-conductor of electricity and should be a protection against electrolysis.

Mr. Fort's tests, made upon 6-inch and 12-inch pipe under hydrostatic pressure, showed no leakage under twenty-five pounds for ten minutes; a slight percolation on one 6-inch section under thirty-five pounds for ten minutes, and a slight one in only two out of sixteen sections under forty-five pounds. The highest pressure obtained without leakage was ninety pounds, while only thirty-three pounds was required.

The Anti-Rust Paint.

Rust has always been the chief argument propounded against steel structures. To combat this rust or oxidation of the steel, structural shapes are painted in the fabricating shops before being sent to the work, then again immediately upon erection, and this is followed in the case the metal is exposed to the elements by repeated painting at very short intervals.

A practical rust preventing paint has been in use for a number of years and has met with favor on this class of work. This paint, Gardiner's anti-rust paint, has been used by the United States Government for the last twenty years on all its battleships.

Briefly, the important points of Gardiner's anti-rust are as follows:

It contains no linseed oil.

Linseed oil paint dries by oxidation, consequently it is impossible to shut out the oxygen from the steel by its use.

Gardiner's anti-rust is made from a base that is a natural insulator. It thus affords protection from electrolysis.

A special feature is that it is unaffected by acids or alkali, consequently in cement or concrete construction a coating of paint applied to the steel imbedded therein will fully

protect it against these destructive agencies.

Robert W. Hunt & Co., engineers, of New York City, comment upon a series of tests which they made relative to Gardiner's anti-rust paint:

We hereby certify that in the light of a series of tests to which specimens of paint made by the Gardiner Paint Company of New York City have just been exhaustively subjected, we find said samples to be proof against rust or corrosion, although each specimen was rigidly submitted to the action respectively of sulphur dioxide, carbonic acid, sulphuretted hydrogen and moist air. Further, we are also prepared to certify to the efficiency of the same paint in its resistance to electrical assault, and this conviction is born of another set of tests for electrical resistance, sufficient of which are now so far completed as to justify our belief that an unusual measure of insulation attributes are contained in the paint mixture in question.

The paint is manufactured by the Gardiner Paint Co., 15 William street, New York City, and is sold throughout the west by Mansfield A. Pakas Co., Minneapolis, Minn.

The Russell Sewage Disposal System.

The Russell Sewage Disposal Company, which was located in Burlington, Iowa, for a number of years, has removed to 607 Marquette building, Chicago, Ill. The company manufactures a number of types of plants for the disposal of sewage from cities and towns, and from public buildings, school buildings and residences.

The disposal of sewage for cities, towns, school houses, summer cottages and country homes where there is no sewer, has been a problem for a number of years. C. W. Russell has discovered, and received patents and copyrights on a system that will dispose of 99 per cent. of the sewage, and discharge harmless water without odor. The Russell system, all parts, is made of the same material that sewer pipe is made of, hard burned glazed clay. It is entirely underground and may be placed in the front yard, or in the cellar. There is no opening to the top of the ground. It liquefies the sewage and discharges a very small amount of clear water which will seep away by laying about 5 feet of 4-inch open joint farm tile.

The first of the Russell sewage disposal systems were installed in 1905. These are still in use and more have been installed in the same towns and cities. A diagram of the system and an estimate of the cost of installation in any individual case will be sent upon application to the Russell Sewage Disposal Company.

Trade Publications.

The Blaw Steel Centering Company, Westinghouse Building, Pittsburg, Pa., offers prizes for the best plans and specifications for small concrete residences of $100, $75, $50 and $25 respectively, the designs for which must be in their hands by May the 15th, 1912.

The Koehring Machine Co., Milwaukee, Wis., have a monthly publication, "The Mixer," devoted to concrete and other mixers. Among those described in the current issue are the Koehring hot mixer, for road paving materials, and some of their standard mixers.

A suitable specification for stucco has been a much-mooted subject and when the metal lath manufacturers of the United States associated themselves for the purpose of working out the problems of the metal lath industry, stucco construction was one of the first things taken up. After over six months of consulting with authorities and conferring with architects, contractors and manufacturers, a typical specification to offer to architects was finally decided upon and has been issued by the Associated Metal Lath Manufacturers, 812 Wick Building, Youngstown, O.

The National Concrete Co., 806 Traction Building, Indianapolis, Ind., have a booklet on the Luten truss, which, in addition to giving examples of its use, has some interesting and valuable data on the design of highway bridges.

Charles J. Williamson, 702 Tenth street, Washington, D. C., has issued a pamphlet covering reinforced concrete patents, their scope and the legal questions involved. Particular mention is made of the Turner "mushroom" patents.

The March issue of the monthly publication of the Universal Portland Cement Co., Chicago, which is devoted to their dealers' interests, contains some valuable advertising data for the retail dealer. The March Bulletin of this company contains an interesting description of factory made concrete curbing, and descriptions of concrete pavements, dwellings, factories and office buildings.

About fifteen attractive designs of ornamental lighting standards are shown in a booklet on "Street Lighting" by the Davenport Machine & Foundry Co., Davenport, Ia. The company manufactures structural iron work and municipal castings.

The Lehigh, the monthly publication of the Lehigh Portland Cement Co., Peoples Gas Building, Chicago, Ill., contains some matter of interest to the sales force, the dealers, the contractors and the engineers who use Lehigh. A description of the Galveston causeway is of particular interest to the engineer.

The Arnold-Creager Co., New London, C., have a catalog of brick machine molds, brick barrows, sewer pipe barrows and trucks, clay conveyors, dump cars, disintegrators and other brick and tile manufacturing machinery.

The Chain Belt Co., Milwaukee, Wis., have a monthly publication, known as "Chain Belt," devoted to concrete construction in general and mixers in particular. Among

the matters treated in the February number are the Black Hawk concrete statue, a number of concrete buildings shown by photographs and a method of figuring the quantities of materials in a cubic yard of concrete

A cloth bound booklet has been issued by the Metropolitan Paving Brick Co., Canton, Ohio, for the convenience of contractors. It comprises a number of tables of weights, measures and in addition a number of pages conveniently ruled for the recording of abstracts of bids.

The National Bridge Co., Indianapolis, Ind. have issued an illustrated leaflet setting forth the decrees on the Luten patents.

The Kurtztown Foundry and Machine Co., 116 N. Broad St., Philadelphia, Pa., have a publication which will be issued occasionally in the interest of education along the lines of garbage disposal. The first issue of this publication, "Garbage," contains a general article on the proper disposal of refuse and a description of the collection of New York City's garbage. Irvin Bain is editor of the publication.

The 1912 catalogue of the "Port Huron Line," appears in the folder form and is very complete as to detail. All machine parts are illustrated and described and their very extensive line of road building machinery is noted in the last portion of the catalog. A copy may be obtained from the Port Huron Engine and Thresher Co., Port Huron, Mich.

The Wheeler Condenser and Engine Co., Carteret, N. J., have a handbook "Steam Tables for Condenser Work." Three tables are especially notable. No. 1 with vacuum referred to a 30-inch barometer as the independent variable, No. 2 with temperature as the independent variable, and No. 3 a table of properties of steam above atmospheric pressure, with gauge pressure as the independent variable. None of these tables have been published before and were calculated especially for this book. In the remainder of the hand book the subject of vacuum measurements and the correction of vacuum gauge and barometer readings is discussed at more or less length.

The February issue of the Universal Portland Cement Co., 72 W. Adams St. Chicago, Ill., contains among other articles a discussion of an unusual type of water storage reservoir, a concrete block chimney, concrete guard rails in New York state, and a number of examples of building construction.

Trade Notes.

ASPHALT.

The Shelby Downa[illegible] Asphalt Co., owner of natural asphalt mines at Ardmore, Oklahoma, have contracted for a plant at Chanute, Kas., for the purpose of refining Oklahoma asphalts, the location being selected because of its geographical center to the territory of the company's activity. Paving cements will be manufactured there for the use of the company in its paving business, and for sale to paving contractors generally. The general offices of the company will remain at Ardmore, Okla.

CEMENT.

The Sandusky Portland Cement Co., Sandusky, O., has just received an order for 100,000 pounds of Medusa waterproofing for use in the New York Dock Company's job at Atlantic Basin, Brooklyn; 5,000 barrels Medusa wateproofed white Portland cement for use in the Woolworth Building, New York City; 25,000 barrels of Medusa gray cement for use in the Central High School building, Minneapolis, and 3,000 barrels of Medusa white Portland cement for use in the same building.

MACHINERY.

Hollywood, Cal.—Special: The Beesemyer Contracting Co., 201 Cugue Bldg., desire prices on one second-hand twenty-five-ton standard revolving steam shovel.

Oak Park, Ill.—Special: H. G. Goelitz, general contractor, 451 North boulevard, desires to purchase the following machinery, either new or second-hand: One portable asphalt plant on cars; tools and complete asphalt paving equipment; two-wheel, seven-ton roller; six dump wagons lined with asbestos and steel, and one street concrete mixer.

Evansville, Ind.: Bedford & Nugent desire to purchase an eight-ton second-hand road roller.

Alliance, O.—Special: C. A. Childers, 113 Twelfth street, desires to purchase a small size concrete mixer for sidewalk work, and also steel sidewalk forms.

East Brady, Pa.—Special: Peter Meyer, general contractor and acting city engineer, desires information with a view to purchasing a concrete tile machine.

Philadelphia, Pa.: Field, Baker & Underwood, Inc., 718 Arcade Bldg., will purchase reinforcing bars, buckets, contractors' supplies, ditching machinery, dump wagons, excavating machinery, hoisting machinery, hose, iron and steel pipe, shovels, wheelbarrows and water-proofing.

Brooklyn, N. Y.: M. V. Woods, 371 Fulton street, will purchase one one-third cubic yard dredge.

Glens Falls, N. Y.—Special: The Matchless Street Cleaner Company, of Glens Falls, N. Y., sole manufacturers of the Matchless sanitary horse sweeping machine and hand cleaning machine, has reorganized and the plant moved to Troy, N. Y. Albert E. Davis, for many years sales manager of the Covert Manufacturing Company, is the new president and L. A. Jones secretary and treasurer of the company.

New York, N. Y.: The city of Huddersfield, Yorkshire, England, has placed the order with the London representative of the Ruggles-Coles Engineering Co., 50 Church street, New York, for two of their Class A-10 dryers for drying sewage cake.

Wausau, Wis.: R. H. Brown, Unity, Wis., county commissioner, desires to purchase road rollers, graders and a complete stone chursh-ing outfit.

MISCELLANEOUS.

Walter B. Snow, publicity engineer, 170 Summer street, Boston, has increased his organization by the addition of Mr. Charles L. Mulligan, late of the editorial staff of the Brooklyn Standard Union, and for a considerable period associated with the publicity department of the Western Electric Co.

Vicente Saucedo, Assoc. M. Am. Soc. C. E., has resigned as chief engineer of the Monterey Water Works and Sewer Co. and of the Monterey Railway, Light and Power Co., and has opened offices for the general practice of engineering in the Banco Mercantile Building, Monterey, N. L., Mexico.

IMPROVEMENT AND CONTRACTING NEWS

PMP

ROADS AND PAVEMENTS.

BIDS REQUESTED.

Talladega, Ala.—April 8. Constructing 4½ miles of gravel road between Talladega and Martinsville; estimated cost, $8,000. Certified check, $400. W. S. Keller, state highway engineer, Montgomery, Ala.

Fort Smith, Ark.—May 1. Constructing 35,000 yds. of pavement on Garrison avenue. City engineer.

Ottawa, Ill.—April 30. Constructing $300,000 of brick pavement. E. L. Farnsworth, city engineer.

Streator, Ill.—April 30. Paving Wasson street with brick. Certified check, 10 per cent. W. W. Bean, chairman board of local improvement.

Anderson, Ind.—April 15, 2 p. m. Constructing a road on the line between Delaware and Madison counties and constructing 1 gravel road in Jackson township, 1 in Monroe township, and 8 in Pipe Creek township. Joel B. Denniel, auditor.

Attica, Ind.—April 8, 7:30 p. m. Improving Park avenue and Jackson street. Samuel Turman, city clerk.

Bluffton, Ind.—April 8, 1 p. m. Constructing 2 gravel roads in Harrison township and stone roads in Harrison and Liberty townships and a macadamized road in Harrison township. L. A. Williamson, auditor.

Danville, Ind.—April 11, 1 p. m. Constructing road on county line between Hendricks and Morgan counties. L. W. Borders, auditor Hendricks county.

Albany, N. Y.—April 15, 17, 19. Bids will be opened on the dates mentioned for the construction of 358 miles of road at an estimated cost of $5,000,000. C. Gordon Reele, superintendent of highways.

Wahpeton, N. D.—April 8, 7 p. m. Constructing sidewalks, curbs, gutters and crossings for the ensuing year. Certified check, $50. Clark M. Colson, city auditor.

Bowling Green, O.—April 10, 1 p. m. Road construction as follows: The Jacob Schramm tar-bound macadam road; Andrew Handley water-bound macadam road; Charles H. Coy water-bound macadam road; the Charles Schumacher water-bound macadam road; the James Daum water-bound macadam road. Certified check, $500 on each bid. C. E. Stinebaugh, county auditor; E. F. Metzger, county surveyor.

Canton, O.—April 12, 10 a. m. Improving the Massillon-Navarre road as follows: 8,331 cu. yds. excavation, 6,227 ft. of 14-in. concrete curb, 1,201 ft. of standard 18-in. concrete curb, 6,227 ft. stone curb, 1,201 ft. stone curb 18-in. 7,159 sq. yds. 4-in. concrete base, 7,159 sq. yds. vitrified brick pavement, 3,000 ft. of 4-in. 209 ft. of 12-in. vitrified sewer pipe. Certified check, $500. J. H. McConnell, auditor of Stark county.

Cleveland, O.—April 17, 11 a. m. Changing the improvement of North Woodland Road No. 2 from brick to Medina block. Certified check, $1,000. Frank R. Landers, county surveyor; John F. Goldenbogen, clerk.

Cleveland, O.—April 24, 11 p. m. Improving the Green road. Certified check, $1,000. John F. Goldenbogen, clerk.

Newark, O.—April 17. Constructing a number of roads in Licking county. C. L. Riley, county auditor.

St. Bernard, O.—April 9, 12 m. Constructing curb and gutter and macadam roadway on Church street. Certified check, $100. M. J. Zoller, clerk.

Freeport, Pa.—April 15, 7:30 p. m. Paving Third street, including 700 cu. yds. grading, 2,000 lin. ft. curbing and 2,800 sq. yds. of vitrified brick paving. C. B. Findley, engineer.

Huntington, W. Va.—April 15, 1:30 p. m. Paving 3 streets and 13 alleys with vitrified paving brick. Certified check, $500. John Coon, commissioner of streets; A. B. Maupin, city engineer.

SEWERS.

BIDS REQUESTED.

Washington, D. C.—April 18. Constructing water works and sewerage system at the White Earth Indian School, Minn. Indian Office, Washington, D. C.

Pierce, Fla.—April 16, 7 p. m. Constructing 7 miles of 6, 8, 10 and 12-in. sewers, together with all flush tanks, and appurtenances. D. V. & C. M. Rodgers, engineers.

New Orleans, La.—April 25, 12 m. Drainage construction and machinery as follows: First, contract 39D, condensing machinery for 6,000-k. w. turbine; second, contract 41D, 2 hydraulically operated sluice gates; third, contract 42D, construction of lined and covered canal on Claiborne avenue; fourth, contract 43D, iron screens for pumping station No. 1. F. S. Shields, secretary; Geo. G. Earl, superintendent sewerage and water board.

New Orleans, La.—April 25, 12 m. Constructing concrete lined canal in Claiborne street, including 9,000 cu. yds. excavation, 1,740 cu. yds. concrete and masonry, 7,310 lineal feet of 36-in. to 6-in. terra cotta pipe. All under contract No. 42D. Certified check, $1,000. F. S. Shields, secretary of sewerage and water board; Geo. G. Earl, general superintendent.

Ludington, Mich.—April 20, 1:30 p. m. Constructing 4,000 ft. of pipe sewer. Certified check, $50. Dean Thompson, city clerk.

Pontiac, Mich.—April 8, 1:30 p. m. Constructing 12,209 lin. ft. of sewers on 2 streets. Certified check, $200 on each bid. C. L. Groesbeck, city clerk.

Mankato, Minn.—April 15. Constructing 9,600 ft. of sanitary sewers from 8 to 18 in. in diameter, with 23 manholes. H. F. Blomquist, city engineer; S. W. Bates, city clerk.

Lakewood, O.—April 15, 12 m. Constructing sewers on West Madison avenue, under 2 contracts. Certified check, $2,000 on each contract. J. W. Chrisford, director of public service.

Roanoke, Va.—April 30, 12 m. Constructing sewers on Kirk and Campbell avenues. Certified check, $50 on each contract. F. L. Gibbony, city engineer.

WATER WORKS.

BIDS REQUESTED.

Washington, D. C.—April 18. Constructing water works and sewerage system at the White Earth Indian School, Minn. Indian Office, Washington, D. C.

Pierce, Fla.—April 16, 7 p. m. Water works construction as follows: 500 tons of 6, 8 and 10-in. cast iron pipe, 50 hydrants, 4 10-in. and 8-in. gate valves, 8,000 ft. galvanized 1½-in. pipe, 1 duplex pump, 150-gal.-per-minute; 1 duplex pump, 500-gal.-per-minute; 1 75,000-gal. tank on 120-ft. tower; 100,000-gal. concrete reservoir, 2 150-h. p. boilers; 1 100-k.v.a. generator; one 50-k.v.a. generator. D. D. & C. M. Rodgers, engineers.

Titusville, Fla.—May 20. Constructing water works system complete, including pumping station, elevated reservoir, water main, hydrants, etc. Geo. M. Robbins, chairman.

Fairbury, Ill.—April 17. Furnishing and erecting a steel water tank. T. B. Karnes, city clerk.

River Forest, Ill.—April 8, 1 p. m. Constructing reinforced concrete reservoir of 150,000-gal. capacity. J. E. Adams, village clerk.

Grand Rapids, Mich.—April 11, 8 p. m. Furnishing 1,000 ⅝-in. meters, 25 ¾-in. disc meters, 5 1½-in. piston meters, 5 2-in. piston meters. Certified check, $50. Edw. H. Christ, president of board of public works; Samuel H. Freshney, secretary and general manager.

Rochester, N. Y.—The board of contracts and supplies will receive bids early in April for 1,623 ft. of cast iron pipe for water main extension, 3,300 ft. of 24 and 42-in. cast iron pipe for section 2, and 730 feet of 16 and 24-in. cast iron pipe for section 4 of the new intercepting sewerage system.

Holdenville, Okla.—April 13, 10 a. m. Furnishing the following machinery and material for water works construction: 15,000 linear ft. of 10-in. cast iron Class A pipe, 20,000 lbs. of lead, 1-inch generator set, consisting of 1 75-k.v.a. generator direct connected to a horizontal engine; 45,000 ft. of No. 6 water proof copper wire, 130 cedar poles, 1 bronze fitted horizontal turbine pump with the capacity of 625 gal. per minute, direct connected to a 35-h.p. motor, and 1 72-in. by 18-ft. horizontal return tubular boiler. Willard E. Levan, city clerk; Doogan & Harper, 920 Scarritt building, Kansas City, Mo., engineers.

Saskatoon, Sask., Can.—March 29, 12 m. Constructing 13 miles of sanitary sewers and water mains. James Clinkskill, chairman city commission; Geo. T. Clark, city engineer.

BRIDGES.

BIDS REQUESTED.

San Bernardino, Cal.—April 8, 11 a. m. Constructing a 250-ft. steel highway Petit truss highway bridge; estimated cost, $12,000. J. Bright, Jr., county surveyor.

Chicago, Ill.—April 24, 11 a. m. Constructing substructure for a bascule bridge over the Chicago river at Thirty-fifth street. Certified check, $3,000. L. E. McGann, commissioner of public works.

Anderson, Ind.—April 15, 10 a. m. Bridge construction as follows: Steel bridge over Pipe creek, concrete bridge over Hillgos ditch and a number of bridge repairs. Joel B. Denniel, auditor.

Crown Point, Ind.—May 8, 12 m. Constructing bridges in East Chicago. C. A. Johnson, auditor.

Grand Forks, N. D.—April 26. Constructing steel and concrete bridges during the year. Hans Anderson, county auditor.

Bowling Green, O.—April 9. Constructing reinforced concrete arched bridge in Ross township, over Grassy creek. C. E. Stinebaugh, county auditor.

Cleveland, O.—April 17, 11 a. m. The constructing of a bridge on McCracken road under report 2919. Certified check, 10 per cent. John F. Goldenbogen, clerk.

Cleveland, O.—April 24, 11 a. m. Constructing concrete bridge on the Lake Shore boulevard under report No. 2920. Certified check, 10 per cent. John F. Goldenbogen, clerk.

Lisbon, O.—April 15, 1 p. m. Constructing steel bridge No. 1041 in Middleton township; estimated cost, $1,000. Certified check, $200. H. C. McCamon, president of board of county commissioners.

New Philadelphia, O.—April 15, 1 p. m. Constructing steel superstructure of the Zoar Station bridge. Certified check, $300. W. C. Shott, auditor of Tuscarawas county.

Youngstown, O.—April 8, 11 a. m. Furnishing the material and constructing 42-ft. bridge on Lowellville road. Certified check, $50. I. M. Hogg, county auditor.

Harrisburg, Pa.—April 12, 12 m. Constructing reinforced concrete arched bridge and a twin-arch stone bridge over Clark's creek. Certified check, 10 per cent. D. Frank Lebo, clerk.

Mitchell, S. D.—April 8. Constructing bridges in Davison county during the ensuing year. R. A. Vangle, county auditor.

Salt Lake City, Utah—April 16. Constructing a girder bridge on concrete abutments on road No. 15E. Margaret Z. Witcher, county clerk.

West Union, W. Va.—April 17. Constructing concrete abutments and steel bridge across the Middle Island creek. U. G. Summers, county clerk.

Calgary, Alberta, Can.—April 15, 12 m. Bridge construction as follows: 2 bridges, span, 125-ft.; 4 bridges, span, 100-ft.; 14 bridges, span, 75-ft.; 9 bridges, span, 60-ft. Certified check, 5 per cent. E. F. Dawson, chief engineer Canadian Pacific Railway Company.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

BIDS REQUESTED.

Ottawa, Kan.—The city of Ottawa is in the market for a garbage disposal plant. Address Dr. W. L. Jacobus.

Morenci, Mich.—The city desires to purchase a street sweeper; second-hand preferred. Mayor Horton.

Marion, O.—The city is in the market for street sweeping machinery and road graders. E. A. Scott, chief engineer department of public service; J. C. Anthony, director.

Hobart, Tasmania.—Consul Henry D. Baker, of Hobart, states that the municipal council wishes information regarding garbage destructors and their cost. Hon. Alfred A. Crisp, mayor.

MACHINERY, MATERIALS AND SUPPLIES.

Indianapolis, Ind. — The Fisher-Goory Coal Co., Indianapolis, has been incorporated for $25,000 by Wm. A. Fisher, president; Wm. P. Cosgrove, vice president; Wm. J. Goory, secretary and treasurer and desires information on cement, sewer pipe, lime, lath, roofing material, and will take an agency for a line of concrete machinery and tools. Office, 708 South Capitol avenue.